Saskatchewan

**Agriculture
and Food**

Managing Saskatchewan Rangeland

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Revised Edition

The revision of this handbook, like the original, concentrates on rangeland resource management in Saskatchewan.

The content emphasizes practical range management. This publication will contribute to the sustainability of the province's rangeland resource.

Managing Saskatchewan Rangeland Revised Edition.

This revised edition has been made possible through the partnership of Ducks Unlimited Canada, Prairie Farm Rehabilitation Administration, Saskatchewan Department of Agriculture and Food and the Grazing and Pasture Technology Program.

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Managing Saskatchewan Rangeland

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Introduction

Rangeland ranks as a major land type and an important resource on a worldwide basis, whether measured by size, support for animal agriculture, wildlife or other source of water. Thirty percent of the world's land area is grassland, 27 percent is classed as forest and 10 percent is considered cropland.

North America pays a high cost in lost production, damaged watersheds, reduced soil organic matter and lost wildlife habitat due to rangeland misuse. Since rangelands consist of ecosystems, traditional agronomic principles of management have met with limited success.

Range management requires through understanding of how ecosystems function.

Efforts to restore grassland productivity and ensure sustainability need must begin with a solid understanding of fundamental ecology. All rangelands respond to management based on ecological principals.

Rangeland planning is the key to improved and sustainable grazing lands. With planning, land managers and producers can achieve overall system improvements.

The Key Steps

Range management planning set goals, identifies limiting factors and makes appropriate adjustments. Managers examine their operation in-depth and questions about past management practices.

This handbook is designed to help range mangers make and carry our these plans. Careful planning can save time and money.

There are seven key steps to rangeland planning: setting goals, resource inventory, problem identification, assessing improvement techniques, implementation, monitoring and goal evaluation.

Goal Setting

Long-term goals help managers decide what is important, objectives, how and when to get there.

Short-term goals are a means of achieving long-term ones, while making necessary adjustments.

A short-term goal, for example, may be to lengthen the effective grazing season without putting undue pressures on native grass stands. This may be achieved by seeding a complementary annual or perennial forage.

The Inventory

This critical step is discussed in detail in the Evaluation section.

Problem Identification

By this stage, any shortfalls or problems should be evident. Managers should also know if goals are achievable.

If there are problems with pasture and range production, identify them and find solutions. If water is a limiting factor, look at developing new sources. Also answer this question: Is more equipment -- or training required ?

Improvement Techniques

Assess various techniques according to suitability and whether they are ecologically and economically sound. This may mean an improved grazing system, more fencing, additional tame pasture, reseeding, fertilizing, burning, water developments, spraying or diversification to different types of livestock.

Base decisions on the merits and short-comings of each technique and how it fits in with long-term goals.

Implementation

The new plan must be implemented in a logical sequence.

Monitoring

A range plan must be monitored to see if desired changes are occurring at the desired rate. This is essential to the planning process because stocking rates fluctuate with yearly weather patterns.

The following questions are important to monitoring a plan:
Am I seeing positive ecological changes on my land ?
Have I lengthened the grazing season ?
Am I producing more beef per acre ?
Do I have higher weaning weights ?
Am I finding it necessary to cull fewer animals ?
Have my overhead costs gone down ?
Is my quality of life improving ?
Are my employees and family feeling more a part of the operation ?

Goals Evaluation

Periodically re-examine goals to see if they need adjustment. Often goals change with time, and what was important last year seems less important now.

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Managing Saskatchewan Rangeland

Open Range to First Ranchers | Early Land Administration and Use | Pre-Depression Overgrazing & Range Research | Great Depression Challenges | Beyond the Crown Land Transfer

Revised Edition

Open Range to First Ranches

It is believed that North American grasslands were a stable ecosystem before European settlement. In Saskatchewan, grazing animals, mainly bison but also elk, deer and antelope, were supported by grasslands and the forest fringe to the north and east.

Native rangelands, name too many other life forms, supported a complex of predators and scavengers: grizzly bear, prairie wolf, coyote, swift fox, eagle, magpie and crow.

Bison numbers dwindled under European settlement pressures. By 1879, extensive prairie fires drove the northern herds deep into Montana where they were hunted to near extinction by buffalo-hide hunters and traders. Pressures on elk, antelope and deer populations then intensified, and these too were greatly reduced in numbers.

Records and diaries from the 1880s show that this was a wet period. Prairie grasses, reacting to the combination of moisture and destocking, benefited and grew abundantly. A cyclic climate of several wet years combined with several drier years followed. The destocked range flourished under light use until about 1920 when the source of grazing pressure shifted from wild animals to large numbers of domestic livestock.

The needs of traders, Indians, settlers, the North West Mounted Police and builders of the Canadian Pacific Railway had all contributed to this increased attention on livestock production and the West's vast sea of grass.

The construction of the Canadian Pacific railway also allowed access to markets in eastern Canada and Europe. Thus began the western Plains ranching era. Among the large spreads was Alberta's Cochrane Ranch Company, a 100,000 acre property established in 1881. Saskatchewan ranches tended to be smaller, with the Fenton Ranch (south of Swift Current) among the province's first large operations.

In 1888, a grandiose ranching plan called the 76 Ranch was registered. Ten 10,000 acre parcels comprised the 76 Ranches, which were spread at intervals between Balgonie and Dunmore, near Calgary. The plan included a grain farm at Balgonie, and sheep and cattle farms at Rush Lake, Swift Current, Gull Lake, Crane Lake and Kincorth. However, capital shortages, lack of local experience and bad luck brought about animal losses from harsh winters and disease. The result was the final breakup of the 76 Ranches in 1909.

Other major Saskatchewan properties of the period included the Turkey Track and the Gull Lake Ranching Company. Directed and funded by absentee owners, like most other large ranches, they soon floundered. Although Texas-based, the Matador Ranching Company was longer-lived, due partly to its ranching management experience.

Between 1900 and 1905 at least 25 small ranches were established south of the South Saskatchewan River, mostly by former employees of the larger ranches.

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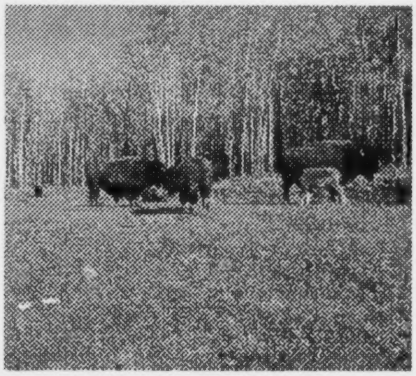
Early Land Administration and Use

In the early ranching era, Saskatchewan rangeland administration was handled by the Government of Canada. The Palliser Triangle, deemed by the early explorer Sir John Palliser to be unfit for farming, extended east from the Rockies into Saskatchewan.

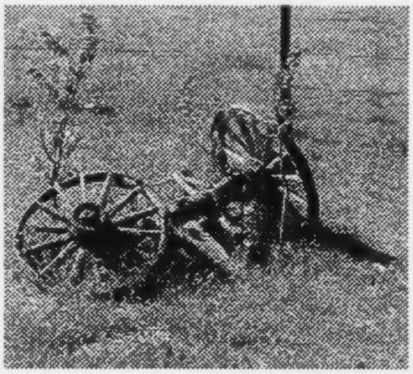


European settlement replaced grassland elk and bison herdswith domestic livestock.

Initially, rangeland was theoretically completely open to purchase, but in practice land tenure existed. In 1881, lease grants of 21 years on areas up to 100,000 acres in size were authorized. The annual rental was one cent per acre. Settlement and use conditions were specified.

Of note was a stocking requirement of one head of livestock per 10 acres. This later became one head per 20 acres and then one head per 30 acres. Once the desired stocking level was attained, the lessee could purchase up to five percent of the land at $2 per acre.

The western land survey was begun in 1871 with the base line being the meridian of longitude immediately west of the Red River settlement boundary. Certain lands remained with the Hudson's Bay Company, two sections were reserved per township as school properties, large land grants went to the railways to encourage line construction, and homestead rights were made available.



Rangeland purchasing and leasing was well under way when the homsteading rush began in 1896.

From 1896 to 1914 the Canadian Government allocated millions of acres of homestead land in Saskatchewan. In addition, the railway and large land companies sold millions more acres.

As settlement increased, regional agriculture was influenced by climate, soil, topography, drainage, transportation and marketing facilities. Generally, the rougher, poorer land became pasture, either remaining as large grazing tracts or as small areas within or adjacent to croplands.

In addition to sheep and cattle, draft horses were a major user of rangelands, increasing to a high of 2,250,000 head in 1926. Horse populations declined slowly until 1945, when they started being rapidly replaced by tractors.

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Pre-Depression Overgrazing and Ranch Research

Lease abandonments due to overgrazing were reported as early as 1912. By 1925, rancher groups in southern Alberta were pressing for review of their lease rates, arguing that set carrying capacities could not be achieved.

After meetings between Experimental Farm personnel and representatives of the Stockmens' Associations, a range survey of southern Alberta and south western Saskatchewan was undertaken in 1926 by L.B. Thompson and S.E. (Doc) Clark.

Experiments were started in 1927 on continuous, rotational and deferred grazing systems, cattle behaviour as an aid to encouraging grazing, development of stock watering facilities, and reseeding abandoned land. Clarke studied grazing of native range, various grazing practice effects, native range improvement by reseeding, surface cultivation and fertilization and growth of cultivated forage crops.

This joint venture between ranchers and scientists become the Manyberries Range Experimental Station. In 1935 Mr. Thompson left Manyberries to direct the Swift Current Experimental Farm, where similar and complementary scientific studies were initiated. Subsequently, grassland research spread to numerous experimental farms, research stations and universities.

Great Depression Challenges

In 1935 the Land Utilization Act was passed to deal with the problem of farmland abandonment resulting from several drought years, unsuitable agronomic practices and the Great Depression. Carrying out the Act's responsibilities, including controlling soil erosion, was undertaken by the Land Utilization Board. Since the Board lacked the resources to address erosion effectively, the Prairie Farm Rehabilitation Administration (PFRA) was established.

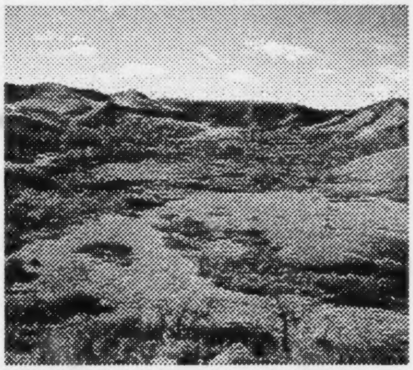
The PFRA began to tackle the problems of soil erosion, water development and land use. By 1937, progress had been made in controlling soil drifting and water development expertise had increased. However, there was not yet a solution to land abandonment.

In 1937, provincial and federal officials held a conference in Regina to seek answers to this problem. Plans were under way to move 100,000 head of southern cattle for which there was no winter feed. It was decided that the federal government would take over these lands and convert them into community pastures operated by the PFRA. By 1942, PFRA administered one million acres of community pastureland in Saskatchewan, eventually managing 1.8 million acres.

Beyond the Crown Land Transfer

Serious overgrazing prompted the start of range utilization research in 1927.

When the Province of Saskatchewan was formed in 1905, Crown land and mineral resource titles remained with the Canadian Government. In 1930, the remaining titles were transferred to the province, bringing about the formation of a Lands Branch in the Department of Natural Resources. The Branch not only administered unpatented public lands, but also inspected homesteads and issued certificates of title to those meeting cultivation and residency requirements.



Abandoned farmland became community pastures

In 1946 the Lands Branch was transferred to the Department of Agriculture and then to Saskatchewan Rural Development of Agriculture and then to Saskatchewan Rural Development in 1988. Today a branch in Saskatchewan Agriculture and Food administer approximately 6.5 million acres of grazing lands.

Of these, about five million acres are leased to farmers and ranchers, 459,000 acres are allocated to PFRA for community pasture purposes, and 660,000 acres are leased to grazing associations and cooperatives. Nearly 768,000 acres of grazing lands are managed directly by Lands Branch as provincial community pastures.

Saskatchewan pasture and rangelands total more than 24 million acres.

While the majority of PFRA pastures are open prairie, 40 of the 56 provincial community pastures are aspen grove or bush pastures. In these pastures, large areas have been seeded to tame grasses.

On all lands, from the brief era of the open range to present day, Saskatchewan's grazing history has seen periods of increasing livestock usage followed by years of reduced grazing pressure.

At times, increased livestock numbers have been a result of grazing land base expansion, or increased productivity through improved range and pasture management. Other periods of increased livestock numbers were the product of high beef/low grain prices. Unfortunately this occurred without equivalent increases in forage availability and led to the deterioration or destruction of provincial grazing resources.

The information in this handbook provides the foundation for better awareness of the principals of sustained management of Saskatchewan's grassland and forested pasture resources.

References and Suggested Readings

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Managing Saskatchewan Rangeland

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Revised Edition

Ecology and Ecosystems

Range Management is applied ecology.

Effective range managers understand ecology, its principles, the interaction of ecosystem components and how management influences them. Desired range management goals are only achieved by applying the principals of ecology. When range management issues or problems are carefully and objectively scrutinized, the solutions always involve these principles.

Ecology is the study of the relationship between organisms and their environment.

Organisms include, microbes in the soil, algae on the soil surface, plants that provide habitats for various insects and animals, and forage for herbivores. The term also encompasses livestock, wildlife, plants and soils.

An ecosystem consists of producers, consumers and decomposers (see Diagram 1). Producers are plants that grow in the soil and use the sun's energy to convert nutrients in the soil into more plant material through photosynthesis. Consumers then eat this plant material, converting it to products used by other consumers including people. Decomposers, mainly bacteria, fungi and insects, break down plant and animal materials plus by products to make nutrients available in the soil again.

This is a delicate cycle where it is extremely important that the consumers, which are livestock, wildlife and people, have to interact efficiency to maintain the producer-consumer-decomposer relationship within the ecosystem balance. Any interruption or reduction in the efficiency of the producer-consumer-decomposer relationship upsets the ecosystem balance, affecting its productivity and sustainability. For optimum results, the range plants must be able to grow in a balanced grazing regime to be able to produce food for the grazers at a maximum level. Without this maximum production the rest of the ecosystem components will suffer.

The Range Ecosystem

Range managers relate ecosystems to the soil-plant-animal complex. This complex develops and functions within environmental limitations.

Many processes operate within each ecosystem component. Water and nutrient cycles constantly function in soils. Photosynthesis, growth, reproduction and death are ongoing in plants.

Diagram 2 illustrates that soils, plants and animals are intimately related. Animal health is dependent on plant productivity, while plant vigour is related to soil conditions. The complex is directly or indirectly influenced by management. Every management action affects all components of the soil-plant-animal complex, eventually filtering back to management again. The functions of the soil-plant-animal system influence management.

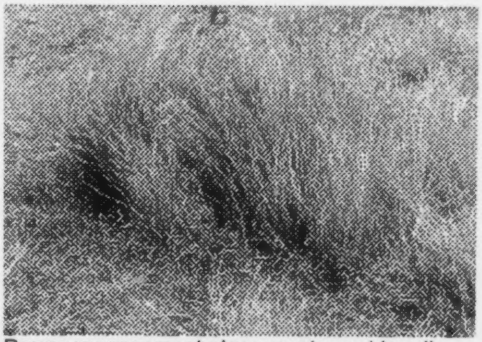
Diagram 1: Simplified relationships between producers, consumers and decomposers in an ecosystem.

Diagram 2: The soil-plant-animal complex model.

Evaluating Management Focus

Range management often concentrates on animal management, resulting in devastating deterioration of plants, soils and the ecosystem in general. Range management should focus on management of the plants, soil and water that make up the range. The animal management philosophy ignores the basic requirements of animal production: healthy soils and plants. End products become the focus, rather than the basic processes and intermediate components essential to producing animal production.

The animal management approach often neglects ecosystem aspects important to human welfare, such as water and wildlife. Soil, plants and animals are not isolated components, but interact to form ecosystems which must be managed as units. A healthy range will result in healthy animals.



Range management plans must consider all aspects of the ecosystem

To minimize negative effects on all components of the soil-plant-animal system, range mangers must develop ecologically based plans.

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These plans should consider environmental limitations and be directed at the ecosystem's producers (plants). It this does not happen, an ecosystem functions below its maximum potential with maximum performance and stability in herbivore performance not realized. Eventually these effects ripple back through the soil-plant-animal system, impacting manager.

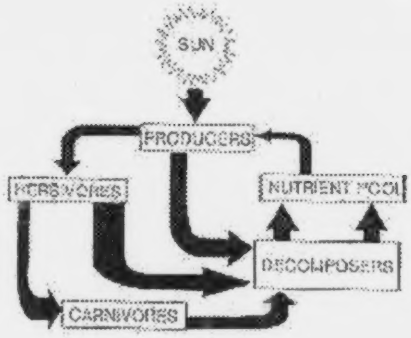
Ecologically Based Management

An inventory of all resources is essential when developing an ecologically based management plan. Knowledge of one's resource base allows charting of management goals and the carrying out of an effective plan. Focusing on goals, it's possible to develop a detailed management strategy directing desire change in the soil-plant-animal complex.

Range mangers should not expect immediate success with first attempts to implement new plans. Evaluate responses of the soil-plant-animal complex and adjust strategy when and where necessary to allow further progress toward the management goal.

Any well-chosen management strategy may cause a positive change in the entire system. Ecologically, management goals should emphasize maximizing ecosystem health over the entire range and sustaining it indefinitely. This also buffers all components of the ecosystem against extremes of weather, insect attacks and other adversities.

Cause-Effect Relationships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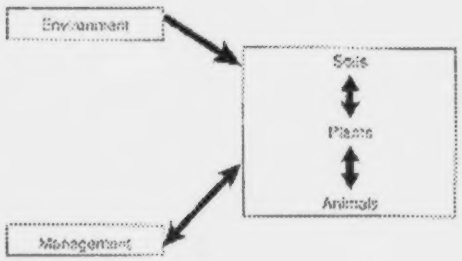
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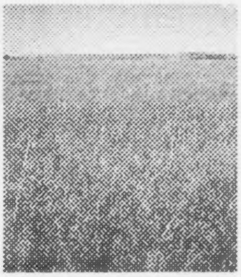
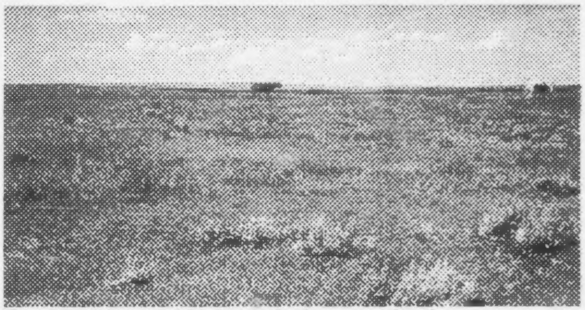


All management activities cause changes in the soil-plant-animal complex. Separating cause-effect relationships from rangeland problems is essential before successful management strategies can be implemented.

Weed infestations are often diagnosed as the cause of reduced plant and animal production on poor-condition rangeland. Attempts to solve this reduced productivity through weed control only result in the problem resurfacing again.

The real cause of reduced productivity is never a weed problem. Weeds are a symptom or effect of improper grazing management. Desired forages have been weakened, allowing weeds the chance to complete and grow. Long-term progress will only occur when management is changed to match forage needs. If management strategy involves using grazing to alter the soil-plant-animal complex, it can either promote the rangeland ecosystem health and condition or deplete resources. Grazing can maintain and promote development of high-producing grassland, or cause deterioration and development of a low-producing and frequently drought stricken range.

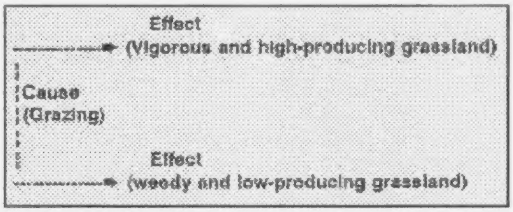


Top: vigorous and high-producing grassland.
Above: weedy and low-producing grassland.

Indirect influences can produce ecosystem responses. Removal of plant litter or dead plant material by grazing of mixed prairie severely reduces productivity. Why this happens is not clearly understood. It may reflect plant environment changes, such as soil and air temperatures, nutrient cycling or the water cycle. Whatever the cause, the productivity reduction indicates a complex ecosystem response to changes.

Often poor management effects are treated rather than correcting the actual cause. Strategies that rely heavily on the repeated use of fertilizers, herbicides and other chemicals, mechanical manipulations such as mowing or seeding, and prescribed fire are usually treating effects of some management shortcoming.

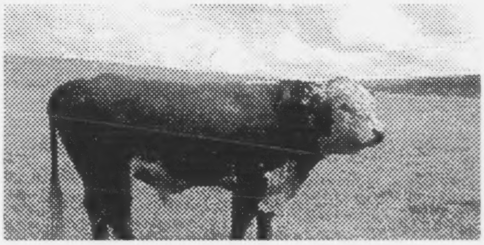
Although poor grazing management is most often the cause of problems, well-planned grazing management provides the most economical and ecologically sound technique to permanently remedy these problems.


Effect
(Vigorous and high-producing grassland)
Cause
(Grazing)
Effect
(weedy and low-producing grassland)

Successional Considerations
Whether or not management actions produce the desired results depends on the ecosystem state, the manager's understanding of the soil-plant-animal complex, and the application of ecological principals. When developing a management plan to promote a healthier ecosystem, one must consider individual plant community factors.

Each plant community is unique. It is the product of soils climate, terrain, kinds and numbers of plants and animals in and around the area, how severely it has been disturbed and past management practices. Since no two plant communities are identical, no two will respond exactly the same to management.

Plant community response to management differs on black versus brown soils.



Likewise, management responses in cooler and moister regions of the province are not the same as in warmer and drier locales. Also expect varying plant community responses when sheep versus cattle are the primary grazers.

Controlling range disturbance is an important management consideration.

Since every farm or ranch has a great variety of soils, terrain and plant types, specific strategies must be designed for each management unit.

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Managing Disturbance to Achieve Goals

From a range management perspective, it's necessary to understand ecological disturbance. Disturbance, which is defined as forces that alter an existing ecosystem, results from grazing fertilizers, herbicides, mechanical treatment, prescribed burning and others.

All management activities alert the soil-plant-animal complex. This impacts rangeland and perennial pastures. While past disturbance determines present health and composition of an ecosystem, current disturbance will shape its future makeup and productivity.

Management mistakes may not be immediately visible and are expressed as long as it takes the ecosystem to repair itself and move toward maximum production. The farther the ecosystem is out of balance, the longer it will take it to return to a desirable state. This time frame is greatly influenced by climatic conditions. The return to potential productivity is usually more rapid in years of favourable environmental conditions than in times of less than optimum conditions.

Range management involves applying disturbance or other activities to achieve predetermined goals. A manager can control when, how often, how long and to what degree a disturbance is applied. These factors should be tailored to suit the particular ecosystem being treated, the ecosystem's present state, and management objectives. Thus all range management plans must be specific to the resources, local conditions and the managers's goals.

Managers can vary the time, frequency, intensity and duration of disturbance to either encourage or hinder the competitive ability, reproduction and death of a particular species or group of plants. This is done either by directly targeting the plants, or indirectly by changing the soil and/or environment surrounding the plants.

Natural ecosystems tend to respond to disturbance in a way that minimizes effects. This buffering allows the land to adjust and support various plants that are best adapted to thrive under particular combinations of time, frequency, intensity and duration of disturbances.

For example, overgrazing leads to a plant community composed of species that avoid or tolerate grazing pressure through various traits. More adapted group of plants will develop if grazing pressure is further increased or relieved.

The specific time that disturbance is applied to an ecosystem is a major management consideration. Soils and plants are more vulnerable to stresses at certain times of the year, growth stages and ages. For example, Clay soils are very prone to compaction in spring when they are wet, but this is a minimal problem in late summer when dry. Similarly, depending on the plant species, all are more sensitive to grazing, burning, herbicides and other disturbances at specific growth stages.

Frequency, or how often disturbance is applied, also shapes the outcome of the plant community. Some plant communities require frequent disturbance to be maintained. For example, there is a natural success on toward forest in the parkland region. If maintaining grassland is the desired goal in this area, relatively frequent disturbance from fires, herbicides, mechanical treatments means or grazing is required for its maintenance. However, too frequent a disturbance of fire or grazing will convert fescue grassland to mixed prairie.

Disturbance duration also induces major ecosystem changes. Plant regrowth differs for grazed species that have endured 30 consecutive days with reduced leaf area than plants that have experienced 10 similar days. Longer disturbance duration always produces greater changes than a shorter one. This concept is one of the most important grazing management considerations.

Maximizing ecosystem health is essential to achieving production goals

Disturbance intensity or severity required to cause a change in the plant community varies, depending on how far it needs to be shifted.

Given a tract of rangeland in poor ecological conditions, assume stocking rates based on the maximum forage production and a management goal of achieving excellent ecological condition. Attaining a positive change in range condition will likely require major stocking rate adjustments because plant production is much less than its potential. However, if this same range were in good ecological condition, major stocking rate changes would not be required.

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Proactive Versus Reactive Management

Range management can be either proactive or reactive. The manager's challenge is to control reactions rather than continually respond to unplanned circumstances. Developing and implementing ecologically based range management allows much grater control, as well as the ability to predict processes and outcomes in the soil-plant-animal complex.

Attempts to maximize livestock production without paying close attention to soils and plants are not effective. Soils and plants are required to support livestock, and not vice versa.

Managing rangelands must be geared toward maximizing ecosystem health. If an ecosystem is properly managed, animal productivity is maximized and sustained. Capitalizing on productivity this way results in more useable outputs and rangeland which sustains resources indefinitely.

Wildlife and Rangeland

Prairie wildlife species are highly adapted to rangeland. Some species of wildlife are widely distributed throughout the vegetation zones of Saskatchewan. Antelope, mule deer, sage grouse, waterfowl and sharp-tailed grouse are found on the prairie. White-tailed deer, elk, waterfowl and ruffed grouse are found in the aspen parkland. Moose, elk and white-tailed deer in Mixed wood zones.

Wildlife have basic requirements such as food, shelter, water and reproductive habitat. Wildlife food sources vary throughout the year. New grass growth or forbs in spring and summer during gestation and birth of the young, changes to leaves and browse through fall and winter. Shelter is sought in forest stands, bluffs, shrubs, tall vegetation around sloughs or in hills and valleys. Water is found either directly from rivers, streams, lakes and sloughs or from succulent vegetation. Reproductive habitat can be tall dense understorey within bluffs or even slough margins.

There may be short time period during spring when there is direct competition between cattle and wildlife, for emerging green plants. For example, spring pastures in the south-west may attract deer and antelope. However, presence of wildlife on areas indicated rangeland health.

Competition also includes trampling of herbaceous and shrub vegetation by cattle during grazing or resting. Understorey changes caused by livestock can reduce food supplies and hiding cover available to wildlife. This reduction is especially determental for young wildlife, who require cover from predators and severe weather.

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Climate and Vegetation

Saskatchewan's vegetation zones run in belts from southeast to northwest, coinciding with moisture and temperature gradients. Natural vegetation is determined by climate, soil and landscape features.

Two main climatic types are present in southern Saskatchewan.

A cold semi-desert climate dominates the southwestern region. Semi-arid conditions prevail since potential evaporation is greater than the precipitation received. Grassland vegetation and soils are associated with this climate.

The grassland area is divided into two types or associations: mixed prairie and fescue prairie. Aspen groves occur in fescue prairie and in eastern portions of mixed prairie. The mixed prairie association has five community types.

A cold forest climate occurs north of the cold semi-desert climate zone. Subhumid conditions in this and other areas, such as the Cypress Hills, allow the growth of aspen groves and forest vegetation. Forest vegetation is comprised primarily of trembling aspen, jack pine and white spruce. Forest types include Aspen Grove, Cypress Hills Forest, Moose Mountain Forest and Mixed Wood Forest.

Complexes exist in localized areas where environmental conditions cause significant differences in vegetative cover. Sandhill, wetland, valley and saline complexes are the most common. Vegetation also varies with site drainage characteristics.

Mixed Grass Prairie

The Mixed Grass Prairie covers a large area of the north central region of North America. In Saskatchewan, mixed prairie occupies a large area of the southwestern part of the province, bordering with the Fescue Prairie to the north and east. In southeast Saskatchewan, elements of Mixed Grass, Tall Grass and Fescue Prairie combine along transition zones occurring between grassland associations.

Various species of wildlife are found throughout the Mixed Prairie Region. Mule deer and antelope are most common in the southwest while white-tailed deer are the common species in southeast. Sharp-tailed grouse are found throughout. Elk and moose are limited to island forest areas such as the Cypress Hills and Moose Mountain uplands. Other species such as sage grouse, ferruginous hawks, and prairie dogs are more closely associated with specific community types. Wildlife diet and habitat use may complement or compete with cattle from time to time throughout the year. (Appendix III)

The Mixed Grass Prairie present in Saskatchewan has five community types are:

Blue Grama/Wheatgrass
This community is commonly found in the southwestern corner of the province on solonetzic soils. These soils are comprised of thin glacial deposits ranging from light loam to clay loam texture that are relatively impermeable. This characteristic, as well as the proximity of the area to the drier part of the Brown Soil Zone, cause solonetzic soils to be

drought prone. Blue grama is the dominant grass over most of the area. The co-dominant, western wheatgrass, is most prevalent in eroded depressions called "burnouts" or "blowouts".

Each of these species contributes about equal amounts to forage yields. However, due to the low growth form of blue grama, it occupies about three to four times the area of western wheatgrass.

The proportion of blue grama to western wheatgrass remains relatively stable with abundant moisture and moderate grazing pressure. Periods of drought and/or heavy grazing result in a blue grama increase and a decrease in wheatgrass. This composition change dramatically affects landscape appearance, with the community taking on a shortgrass look. However, the shortgrass vegetation type only occurs in Saskatchewan as a disclimax caused by poor grazing management.

Some other principle grasses and sedges present are needle-and-thread, June grass, Sandberg's bluegrass, plains reed grass, thread-leaved sedge and low sedge. Loamy sites tend to favour needle-and-thread while eroded sites favour thread-leaved sedge.

Dense club-moss may occupy up to 30 percent of the ground cover in well managed areas.

Forbs and shrubs represent a small part of the total vegetation, with pasture sage the most abundant forb. Prickly-pear cactus and moss phlox are two of the more common forbs. The most prevalent shrub is silver sagebrush.

Winterfat and Nuttall's Saltbush (Atriplex), two valuable shrubs, also occur in the area. These plants can provide late grazing, but require careful management to maintain productivity.

The large native areas attract several provincially unique species, and are the "core range" for many prairie wildlife birds and mammals.

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Eco Region Map

Climate

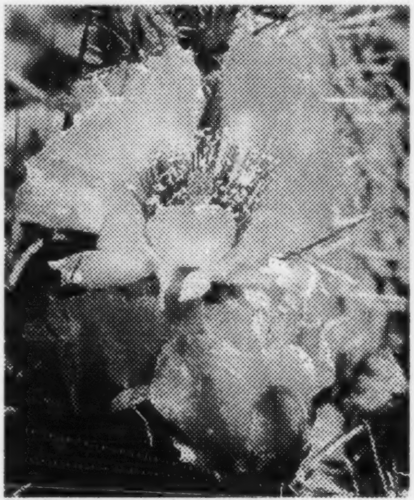
Prairie falcons, eagles, ferruginous and Swainson's hawks rest and fledge their young in this largely undisturbed area where prey such as Richardson's ground squirrels and white-tailed jack rabbits are common.

Sage Grouse are found in this community. They are the largest member of the grouse family and are true prairie dwellers. They ae influenced more by the availability and distribution of sage brush than any other environmental factor. (Appendix III)

Needlegrass (Needle-And-Thread)/Blue Grama
This community occurs in the drier part of the Brown Soil Zone. Medium-textured soils developed from glacial deposits and coarse-textured soils developed from glacial deposits and coarse-textured soils originating from alluvial deposits characterize this type.

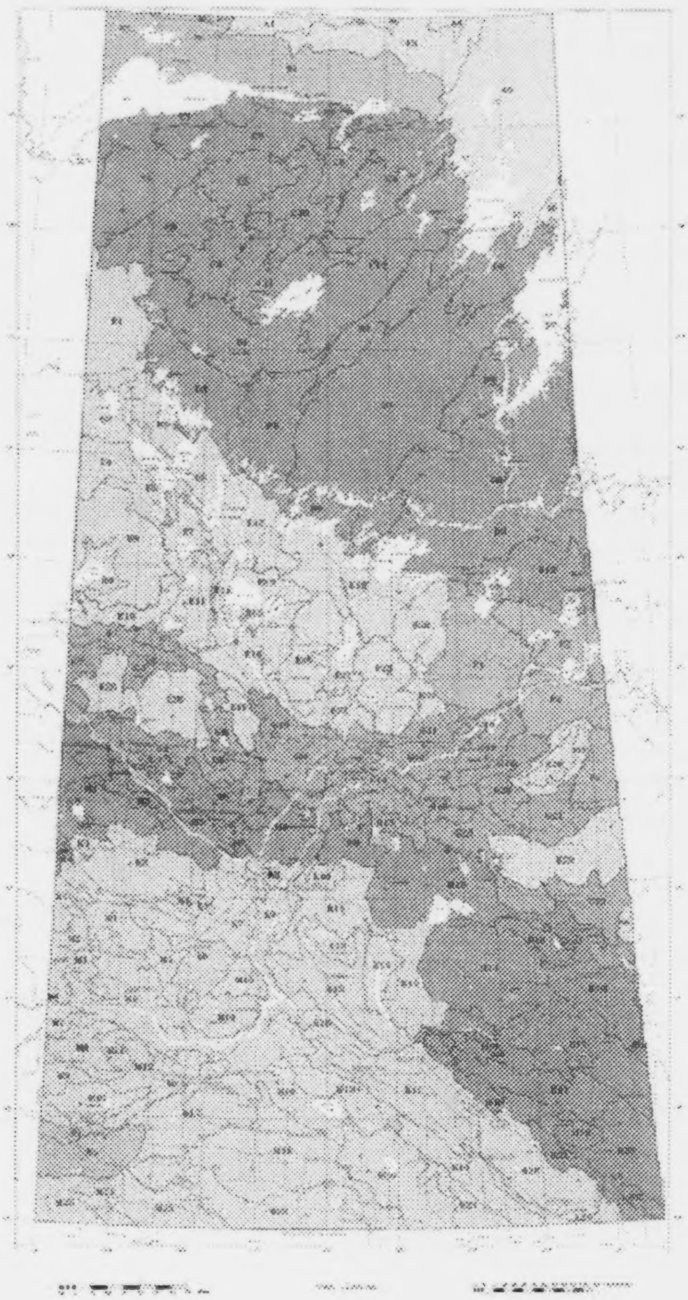
The dry climate and drought susceptible soils inhibit midgrass growth.

Blue grama is the dominant grass, occupying about three times as much area as needle-and-thread. However, due to the taller growth form of needle-and-thread, it contributes almost as much to total forage yields as blue grama. Together these two grasses represent about 70 percent of the plant cover.

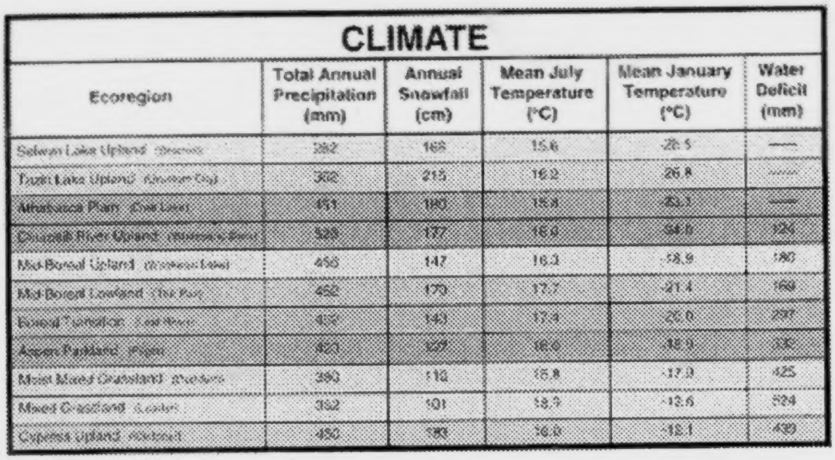


Prickly-pear cactus is common on sandy sites in the blue grama/wheatgrass community.

Other principle grasses and sedges in order of importance are low sedge, June grass, northern wheatgrass, western



Credit: J.L. Henry and H.K. Harder,
Saskatchewan Institute of Pedology (SIP)
University of Saskatchewan, 1991.



CLIMATE

Ecoregion	Total Annual Precipitation (mm)	Annual Snowfall (cm)	Mean July Temperature (°C)	Mean January Temperature (°C)	Water Deficit (mm)
Selwyn Lake Upland [illegible]	282	168	15.6	-28.5	——
Tazin Lake Upland (Uranium City)	302	215	16.2	26.8	——
Athabasca Plain (Cree Lake)	451	180	15.8	-23.1	——
Churchill River Upland [illegible]	523	177	16.0	-24.8	124
Mid-Boreal Upland [illegible]	456	147	16.3	-18.9	180
Mid-Boreal Lowland (The Pas)	452	170	17.7	-21.4	160
Boreal Transition [illegible]	432	143	17.4	-20.0	237
Aspen Parkland [illegible]	423	107	18.0	-18.9	330
Moist Mixed Grassland [illegible]	390	118	18.8	-17.9	425
Mixed Grassland [illegible]	352	101	18.9	-13.6	524
Cypress Upland [illegible]	450	183	16.0	-12.1	439

wheatgrass, thread-leaved sedge and western porcupine grass. The secondary grasses and sedges are Sandberg's bluegrass, plains reed grass, plains muhly and sun-loving sedge. Sand grass and sand dropseed are abundant in localized areas with coarse soil.

Dense club-moss is not as abundant as in the blue grama/wheatgrass type, covering less than 10 percent of the ground surface.

Forbs and shrubs furnish approximately 15 percent of the community's composition. Pasture sage, the principle forb, contributes about 75 percent of this amount. Moss phlox is the second most abundant forb.

Shrubs are more common in this type than the blue grama/wheatgrass community. The most common shrub is silver sagebrush, accounting for 90 percent of this component.

This extensive community is inhabited by many wildlife species including antelope, mule deer, coyote, badger and smaller mammals and birds.

Prairie Falcons and Ferruginous Hawks are common hunters throughout this community, feeding on small rodents. (Appendix III)

Again, overgrazing reduces midgrasses and increases low-growing grasses and sedges. Productivity declines as the midgrasses disappear, followed by increases of weed species. This community, like the blue gramma/wheatgrass type, is often incorrectly referred to as a shortgrass prairie when overgrazed.

Response to Grazing

Decreasers	Increases	Invaders
needle-and-thread	blue grama	Russian thistle
wheatgrasses	Sandberg's bluegrass	others
June grass	plains reed grass	
porcupine grass	plains muhly	
sand dropseed	pasture sage	
sand grass	moss phlox	
thread-leaved sedge	dense club-moss	
winterfat	scarlet mallow	
Nuttall's atriplex	broomweed	
silver sagebrush	rose cactus	

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Needlegrass/Blue Grama/Wheatgrass

This community occurs in the Brown Soil Zone and the drier parts of the Dark Brown Soil Zone. Associated soils are generally of medium texture, loam to sandy loam, and developed from undifferentiated glacial till. This type is also found on soils developed from glacial outwash with undulating topography.

Two needlegrasses, needle-and-thread and western porcupine grass, dominates this community. Needle-and-thread is dominate on drier sites, while porcupine grass is prevalent on moister sites.

The co-dominant grasses, blue grama and wheatgrass, also share an inverse relationship respecting moisture.

Soils which retain moisture well support porcupine grass and wheatgrass, while drier soils support needle-and-thread and blue grama.

Mixed prairie Matador Pasture

In hilly topography, knolls and upper slopes are dominated by blue grama and needle-and-thread. Mid slopes support needle-and-thread, blue grama and wheatgrass. Porcupine grass and wheatgrass occupy lower slopes.

Annual precipitation variations can dramatically change this community's appearance, with periods of drought causing a shift in species composition. Favourable moisture conditions enable midgrasses to flourish, almost entirely masking the forbs. Forbs become very noticeable as the midgrass culms shorten or disappear.

Needlegrass, the dominant producer, furnishes from 35 to 40 percent of forage yields. Together, needlegrass and the co-dominant grasses and low sedge represent more than 50 percent of the community's composition. Several other grass species are present in this community.

Northern wheatgrass and June grass are found on moister sites with heavier soils. Coarse-textured soils in the area's drier part favour Sandberg's bluegrass and plains reed grass. Plains muhly and thread-leaved sedge are common where erosion has removed part of the topsoil layer. Species associated with more moist sheltered sites (northern slopes) including rough fescue, Hookers's oatgrass and green needlegrass.

Dense club-moss occupies between five and 10 percent of the soil surface. Pasture sage and moss phlox make up the bulk of the forbs. Some of the more common forbs include scarlet mallow, crocus, goldenrod, broomweed, spiny ironplant, silverleaf psoralea and skeletonweed. Shrubs grow in localized areas where moisture is available. Western snowberry, rose and wolf-willow are most common, while silver sagebrush occurs in drier areas.

Colonies of black-tailed prairie dogs in the Frenchman River Valley comprise the only occurrences of this rodent in Canada. Sharp-tailed grouse are conspicuous on their dancing grounds (leks) in the early morning hours during the spring throughout this community. Young chicks are highly dependent on grasshoppers and other insects until they approach adult size. (Appendix III) Antelope and mule deer are the common big game species which seasonally utilize this community. Piping plover may be seen on sandy beaches of permanent saline wetlands.

Response to Grazing

Decreasers	**Increases**	**Invaders**
rough fescue	blue grama	Russian thistle
western porcupine grass	Sandberg's bluegrass	dandelion
western wheatgrass	June grass	Kentucky bluegrass
green needlegrass	plains reed grass	other
northern wheatgrass	plains muhly	
needle-and-thread	sedges	
	pasture sage	
	moss phlox	
	dense club-moss	
	scarlet mallow	
	crocus	
	broomweed	

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Wheatgrass/June Grass

This community is located in the moister part of the Brown Soil Zone, as well as the drier part of the Dark Brown Zone. Associated soils are typically uniform lacustrine clays, deposited in glacial lakes.

Due to its high value for annual crops, a large part of this type has been destroyed through cultivation.

Soil uniformity combined with a relatively low species diversity results in a grassland with a very even appearance. The dominant grasses cover nearly 75 percent of the area. The wheatgrass component alone furnishes almost half the cover, of which over 80 percent is northern wheatgrass.

Fair condition, Clayey range site

All species present are midgrasses, with northern wheatgrass the most abundant. June grass occurs more frequently in this type than elsewhere, contributing nearly 25 percent of the cover. Western wheatgrass supplies only five to seven percent to the community's composition.

Green needle-grass, the only other major important grass, represents about 10 percent of the plant cover. Thread-leaved sedge is the only component of the grassland's lower layer, providing between 10 and 15 percent of the cover. Sandberg's bluegrass, early bluegrass, and plains muhly occur as secondary grasses.

Wheatgrass range in poor condition

Forbs are less frequent than in any other mixed prairie type. Pasture sage and moss phlox represent approximately 75 percent of the forb component. Other forbs include aster and yarrow. Dense club-moss is not present in any appreciable amount.

As in most fine-textured soils, the shrub winterfat is present.

Overgrazing of these areas result in decreased amounts of winterfat and an increase of species usually associated with loamy soils. Severe overgrazing eventually leads to a dramatic increase in prickly-pear cactus.

Due to the fact that most of the land is currently being cultivated, this community has low capability as wildlife habitat. Hungarian partridge and other wildlife species concentrate wherever major farm shelterbelts are present.

Response to Grazing

Decreasers	**Increases**	**Invaders**
northern wheatgrass	blue grama	Russian thistle
western wheatgrass	June grass	others
green needlegrass	Sandberg's bluegrass	Smooth Brome
Western porcupine grass	early bluegrass	
plains muhly		
thread-leaved sedge		
pasture sage		
winterfat	moss phlox	
	aster	
	yarrow	
	everlasting	
	prickly-pear cactus	
	rose	
	silver sagebrush	

Needlgrass/Wheatgrass (Western Porcupine grass/Northern Wheatgrass)
Prior to settlement, this type was the largest grassland association of the mixed prairie. It occurs on Brown, Dark Brown

and Black Soils.

This grassland is found on loamy sites in the moister part of the Brown Soil Zone. It occupies an extensive area of the Dark Brown Soil Zone, generally on medium-textured soils. The community occurs in southeastern Saskatchewan on Black Soils associated with aspen groves.

This type tends to be a transition zone between the mixed and fescue prairies. Midgrasses represent from 70 to 80 percent of yields.

Western Porcupine Grass is the dominant species, while northern wheatgrass is the co-dominant. The primary grasses and sedges associated with these two species are needle-and-thread, green needlegrass, western wheatgrass, June grass and thread-leaved sedge.

Rough fescue, awned wheatgrass, slender wheatgrass, early bluegrass and Canada bluegrass are some of the other grasses growing in the community. Little bluestem, a warm-season grass associated with the tall-grass prairie, is also present. Blue grama is found locally on exposed slopes and dry soils.

Like other mixed prairie types, pasture sage is the most abundant forb. Moss phlox and dense club-moss are present on drier sites, but are absent from the more favourable areas.

Shrubs are similar to those of the needlegrass/blue grama/wheatgrass type, except for silver sagebrush. Western snowberry, rose and wolf-willow are the most common.

Needlegrass/Wheatgrass range in excellent condition

Poor condition, Needlegrass, Wheatgrass, (Blue grama), Matador

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White-tailed deer and mule deer are the most conspicuous big game species in this community. Upland game birds are also common. Sharp-tailed grouse are found within grass-dominated pastures and native song birds are attracted to shelterbelts and farmyard sites. Carnivores like the red fox and badger and raptors such as Swainson's hawk prey on numerous small mammals and birds.

Overgrazing of this grassland will initially lead to a reduction in porcupine grass and wheatgrass. Surviving midgrasses, such as needle-and-thread and June grass, remain small and unproductive. Kentucky bluegrass is a common invader of this type's moister areas. Easily recognizable overgrazing indicators are everlasting, yarrow, broomweed and crocus.

Response to Grazing

Decreasers	Increases	Invaders
porcupine grass	blue grama	Kentucky bluegrass
wheatgrass	June grass	
rough fescue	needle-and-thread	dandelion
green needlegrass	Sandberg's bluegrass	Canada thistle
	Canada bluegrass	Russian thistle
	plains muhly	smooth brome
	little bluestem	
	pasture sage	
	moss phlox	
	dense club-moss	leafy spurge
	everlasting	others

yarrow
western snowberry
rose

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Fescue Prairie

Fescue grassland occurs in the Black Soil Zone in western and central Saskatchewan, as well as in the benchlands and upper slopes of the Cypress Hills. The associated soils dark colour is the result of an accumulation of organic matter from rough fescue.

This grassland's climate has a greater moisture effectiveness (higher precipitation lower temperatures) than the adjacent mixed prairie. Rough fescue can comprise up to 90 percent of the cover in some Cypress Hills locations and northern parkland areas.

In the Cypress Hills, shrubby cinquefoil is the characteristic shrub. Awned wheatgrass, timber oatgrass, Hooker's oatgrass and western porcupine grass are common. Several low-growing sedges occur among these plants, including low, sun-loving and blunt sedge. Secondary grasses are June grass, western and northern bedstraw, violet, crocus, pasture sage and goldenrod are among the more common herbs.

Abundance of pasture sage indicates poor range condition

In the Northern Parkland, snowberry and wolf willow ate the characteristic shrubs. Further south, the relative abundance of rough fescue decreases as western porcupine grass increases. The southern part of the region is a transition zone between the fescue and mixed prairies.

Besides rough fescue and porcupine grass, this community's primary parkland grasses are awned and slender wheatgrass, Hooker's oatgrass, low and sun-loving sedge and June grass. Western and northern wheatgrass, plains reed grass, timber oatgrass, little bluestem and blue grasses make up the secondary grasses. The most common herbs are similar to those of the Cypress Hills region. The shrubs rose, western snowberry and wolf-willow occur in localized areas.

The Cypress Hills forest is a lodgepole pine/rough fescue association

Elk and moose are common in the Cypress Hills and elk may compete with cattle grazing. (Appendix III) Pine martens, which prey on red squirrels, can be found in the lodge pole pine complexes within the park. In the northern areas white-tailed deer are the dominant game species. Sharp-tailed grouse, red-shatted flicker, dusty flycatcher and ruffled grouse are common upland bird species.

Clay-coloured sparrows, red-tailed hawk, coyote, and porcupine are also found in the tree-shrub-grassland complexes.

Although very productive, rough fescue is very sensitive to overgrazing. Continued heavy use can almost eliminate it from the community, encouraging a noticeable increase in needlgrass, June grass, blue grama and pasture sage.

Response to Grazing

Decreasers
rough fescue
awned wheatgrass
slender wheatgrass
green needlegrass
Hooker's oatgrass

Increases
western porcupine grass
June grass
western wheatgrass
needle-and-thread
blue grama
pasture sage
yarrow
everlasting

Invaders
smooth brome grass
Kentucky bluegrass
timothy

Canada Thistle
dandelion
leafy spurge

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Complexes

Areas occur in most grassland associations where local soils, climate and moisture conditions vary drastically from the norm. The plant cover in these areas often varies more than in the surrounding plant community.

Called complexes, these areas contain plant species that have adapted to local conditions. There are four common complexes that may be present in the mixed grass and fescue prairies.

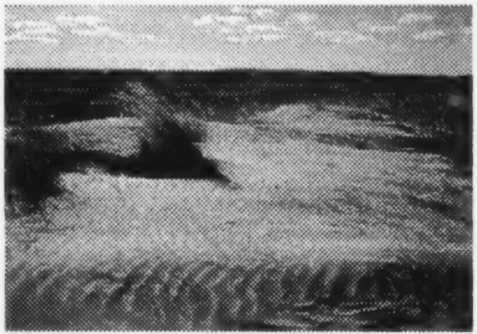
Sandhill Complexes
Aridity is the most important factor influencing this area's vegetation survival. Only well-adapted species are present.

Rough fescue range in excellent condition

Five types of sandhill complexes occur: active complex, stabilized blowouts, stabilized dunes, dune depressions and sand flats.

Active complexes are exposed areas of presently shifting sand. The first plants to colonize these area have extensive root systems. These "sand binders" thrive on being buried. Bare sand pioneer grasses include northern wheatgrass, Indian rice grass, sand grass, Canada wildrye and sand dropseed. Lance-leaved psoralea, sunflower, skeleton weed and veined dock act as forb pioneers. Wolf willow and sand-bar willow are characteristic shrubs.

Stabilized blowouts show signs of recent erosion. Most of the pioneer plants have been replaced by more permanent species like needle-and-thread, June grass, sun-loving sedge, goldenrod and pale comandra. Pioneer plants which typically survive to this succession stage are northern wheatgrass, sand grass and lance-leaved psoralea. Bearberry and creeping juniper are the typical shrubs.



Sandhill complexes consist of active and stabilized dunes

Stabilized dunes show no evidence of recent erosion. Needle-and-thread is the dominant species. Associated grasses and forbs are the previously described "sand binders", and those appearing in the needlegrass/blue grama and needlegrass/blue grama/wheatgrass types.

The most obvious big game wildlife species in this complex are mule deer and antelope, with mule deer inhabiting the more rugged terrain. Cooper's hawk, red-tailed hawk, Swainson's hawk and ferruginous hawk frequent this area, using the cotton woods, aspens, or tall shrubs for nest sites. Thirteen-lined ground squirrels and deer mice are abundant. The Ord's kangaroo rat is a desert-adapted mammal which is unique to sandhill areas in southwestern Saskatchewan.

Dune depressions and sand flats occur between stabilized dunes. Generally the water table is shallow, resulting in abundant growth of shrubs and other woody species. Rose is the most frequently found plant, while wolf-willow, western snowberry and chokecherry are common. Silver sagebrush is the dominant shrub species in the Great Sand Hills. Trees such as willow, trembling aspen and birch exist in locations where moisture is sufficient. Jack pine and white spruce occur in more northern regions.

Saline Complexes

Particularly common in the mixed grass region, saline complexes are generally associated with flat low-lying areas having poor internal drainage. They are also found along watercourses, sloughs and dry lakes. The soils involved are usually alluvial and lacustrine deposits.

The soluble salts concentration and flooding frequency determine the vegetation present. Hydrophytic plants occur on areas experiencing periodic flooding. Halophytic species exist in dry areas where water does not accumulate on the surface. Salinity levels are often lower in the former since periodic flooding flushes salts away.

Saline complexes are common in Saskatchewan

Distinct vegetation zones are found in saline complexes. In saline sloughs, the deeper depressions that retain water most of the growing season are dominated by prairie bulrush, sedges and rushes. The highest salt concentration occurs in the adjacent area, which is often bare. Red samphire, sea-blite, saline goosefoot and sea-milkwort can all survive in this region. The surrounding area is dominated by desert salt grass, foxtail barley, Nuttall's salt-meadowgrass, slender wheatgrass, arrow-grass (poisonous species), alkali cord grass, canby bluegrass and perennial sow-thistle. Also present in less-saline areas are tufted hair grass, western wheatgrass, mat muhly and northern reed grass.

The response of these species to grazing varies according to the available moisture. Nutall's salt-meadow-grass and slender and awned wheatgrass are decreasers at all sites. Western wheatgrass increases on abundant-moisture sites. Mat muhly, canby bluegrass and foxtail barley are increasers.

Saline complexes support populations of birds and have a low capability for large mammals due to a lack of woody plant species. Waterfowl such as duck, geese, cranes, swans, grobes, coots, and shorebirds utilize these areas for all or a portion of the year. Short eared owls nest on marshy grasslands. Falcons are frequently seen as they follow migrating shore birds. Common shore birds are American avocet, marbled godwits and willets. Saline mudflats or the Quill Lakes and Old wives Lake to Chaplin Lake support the largest populations of breeding piping plovers, and endangered species, in the province.

Continuos heavy grazing leads to a community dominated by foxtail barley.

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Wetland Complexes

Most of Saskatchewan's prairie region is dotted with numerous shallow depressions, or sloughs. Sloughs are recharged each spring from adjacent uplands and overflowing streams.

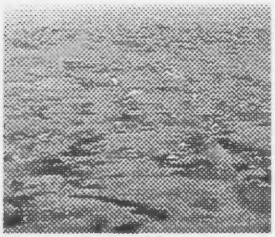
Wetland drainage has a large effect on existing vegetation. Wetlands that do not overflow, or closed drainage basins, tend to accumulate salts and are associated with salt-tolerant vegetation. Overflowing depressions regularly support freshwater vegetation.

Both freshwater and saline wetlands display distinct vegetation zones as the moisture gradient changes.

Cattail and bulrush are common deep marsh emergencies in freshwater wetlands. Reed grass and bulrush are also common in the deep marsh zone. Shallow marsh regions are often inhabited by creeping spike-rush, awned sedge, whitetop, smartweed, water parsnip, reed grasses, and tall manna grass. Plants found in the outer margin of the wetlands or wet meadow are marsh reed grass, tufted hair grass, baltic rush, sweetgrass, cattail and canby bluegrass. These margins are often lined with a shrub fringe, usually willows in the moister areas lined with a shrub fringe, usually willows in the moister areas and western snowberry in the direr regions.

Changing water depth, grazing, mowing and fire are among several factors which can alter vegetation. As the water depth changes the vegetation changes, resulting in some basins being entirely dominated by cattails, bulrushes, whitetop, smartweed or willows. Grazing and mowing encourage spike-rush and whitetop dominance. Burning weakens cattails and bulrushes and in drier years allows expansion of species like whitetop.

Saline wetlands are characterized by dense stands of coarse emergents like prairie bulrush. The saline mud flats contain the greatest salt concentration, supporting only the most salt-tolerant vegetation such as sea-blight, saline goosefoot and sea-milkwort. The outer zone vegetation is the same as found in saline complexes.



Wetlands provide water, grazing and cover for livestock and wildlife

The major wildlife use of wetlands is that of waterfowl production. Waterfowl require three types of habitat; nesting, moulting and staging or migration.

Diving ducks such as canvasback or redhead nest over the water on dense emergent vegetation. Dabbling ducks such as mallard, pintail or blue wing teal nest on uplands adjacent to wetlands. These ducks prefer unhayed or lightly grazed grassland for protection against predators during the nesting period. If haying or heavy grazing occur late in the growing season, nesting success is greatly reduced the following year, due to a lack of protective cover.

Many other wildlife species are commonly found in wetland complexes. Red-winged and yellow-headed blackbirds nest in willows and cattails on wetland margins. Marsh wrens and common snipe are regularly found in shallow grassy and sedge marshes.

Sharp-tailed grouse are often seen in the tree-shrub perimeter of these complexes. The tree-shrub perimeter are also important for white-tailed deer in terms of food and escape cover and the dense grass and forb vegetation in these areas provide excellent fawning areas in the spring.

Although wetlands can be very productive in terms of forage yields, careful management is necessary. Since soils are often marginally saline, continous heavy grazing can change the community composition to one dominated by foxtail barley.

Valley Complexes

Glacial drainage channels eroded through the plain provide a range of habitats from badlands to flood plains. Valley vegetation varies with degree and aspect of slopes and available moisture.

North-facing slopes provide more favourable growing conditions than the prairie above. Species not commonly found in the area can exist on these sheltered slopes. Western snow-berry, wolf-willow, willow and aspen are common here.

Southern exposures support drought-tolerant species.

Valley bottoms are wetland, saline or flood plain complexes. The wetland and saline complexes are similar to those previously described.

A glacial valley complex

Flood plains occur in valleys with a permanent watercourse. Soils in these areas are constantly eroded and deposited. The local vegetation varies with flooding frequency.

These land forms are often seen as "oasis" of native habitat diversity within the vegetation zones they are found. This is reflected in the number of wildlife species that inhabit these areas. Many unique, and in some cases, rare birds, mammals, reptiles and game species are found.

The steep slopes provide nesting habitat for eagles and ferruginous hawks. These large, soaring raptors can easily hunt over the slopes because of wind updrafts produced by slopes. Aspen stands in steppes and coulees of the valley walls are used by red-tailed and Swainson's hawks, great horned owls and merlins. Mule deer, antelope, sharp-tailed grouse, rattle-snakes, coyotes, bobcats and white-tailed deer also frequent these areas.

Uncultivated portions of the valley floor are used by antelope, deer and upland birds. The best known populations of sage grouse and prairie dogs are found in the Frenchman Valley complex. In this valley rare species like the yellowbellied racer snake and horned lizard are occasionally sighted.

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Forested Rangelands

The forests of Saskatchewan are not always considered rangeland even though they fit the definition of rangeland in many cases, as they provide forage and shelter for livestock and wild herbivores. These herbivores are dependent mainly on understorey vegetation for sustenance and cover. Forested rangelands occupy about 325,000 km2 or about 50 % of Saskatchewan's land base. Interaction of environmental factors such as climate, soil and topography, favours forest growth in these rangelands. However, there are ecological aspects specific to each type.

Aspen Grove

Aspen Groves or the Aspen Parkland area is climatically and ecologically a transition zone between grasslands and Boreal Mixedwood Forest. It occupies primarily the Black Soil Zone and in eastern Saskatchewan a portion of the Dark Brown Soil Zone. It is characterized by Chernozmic soils and aspen grove interspersed with open grassland and shrub communities. Prairie fire suppression since settlement has caused the southward expansion of these groves into the grasslands.

Trembling aspen dominates groves in moist well-drained sites, in association with fescue grassland in the west and needlegrass/wheatgrass in the east. Balsam poplar occupies localized areas where moisture is plentiful. A shrub transition zone between the grove and grassland exists with western snowberry, wolf willow, rose, raspberry and buffalo berry being the most common species.

Where trembling aspen dominates, common understorey shrubs include rose, Saskatoon, western snowberry, wolf willow, chokecherry, twining honeysuckle and narrow-leaved meadowsweet. Common forbs include aster species, bedstraw, bunchberry, sarsaparilla, American vetch, peavine, two-leaved Solomon's seal and Star-flowered Solomon's seal. Dominant grasses include purple oatgrass, wheatgrasses, reedgrass, Canada and hairy wildrye and fringed brome.

Understorey shrubs associated with balsam poplar on wetter sites are red-osier dogwood, willow species and currant. Common forbs in these sites include horsetail, coltsfoot, bedstraw and bishop's-cap. The grass component consists mainly of reedgrass, bluegrasses and wheatgrass.

The diversity of grassland, aspen groves and understorey provides valuable habitat for many wildlife species. White-tailed deer utilize these groves for food, escape cover and shelter from severe weather year round. Heavy grazing pressure reduces vegetation carry over of understory forage species. Trampling and grazing of shrubs reduces the cover in fawning areas which leaves fawns susceptible to predators.

Aspen grove wildlife species also included clay-coloured sparrows, ruffled and sharp-tailed grouse, red-tailed hawks, great horned owls, porcupines and snowshoe hares. Numerous wetlands provide habitat for waterfowl, grebes, terns and shorebirds.

Cypress Hills Forest

A lodgepole pine/rough fescue association, this forest occurs on Black and Dark Brown Soils at elevations greater than 900 metres above sea level. Lodgepole pine and trembling aspen dominate well drained upland sites, while white-spruce and balsam poplar are common in moist areas. The pine stands' understorey is sparse, with shiny-leaved meadowsweet and bearberry the most common species. A rich understorey is present where trembling aspen is more abundant.

Rough fescue dominates well-drained level uplands, with oatgrass and shrubby cinquefoil common. (See Fescue Prairie section for more information.)

The aspen parkland is a broad transition zone between the southern grasslands and northern Mixed Wood Forest which supports substantial cattle herds.

The diversity of vegetation associated with the extreme altitudinal variation has benefited wildlife species common to southwestern Saskatchewan. Forested upland areas are attractive to moose, elk, mule deer, white-tailed deer and ruffed grouse. Steep slopes provide nesting habitat for ferruginous hawks while aspen stands are used by red-tailed and Swainson's hawks, great horned owls and merlins. Many song birds more typical habitats mountains, such as Audubon's warbler, Oregon Junco, Poor Willow and dusky fly catcher, are found only in this part of the province.

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Moose Mountain Forest

An aspen forest with interspersed wetlands and moist meadows, this area's soils are black and dark grey, originating from glacial till.

Bush pasture

Trembling aspen dominates the area, with occurrences of birch, balasm poplar and green ash. Willows surround moist low areas. Common understorey species are fringed brome, bluegrass, sarsaparilla, beaked hazelnut, rose, red-osier dogwood, saskatoon, gooseberry, raspberry, wolf willow and western snowberry.

Slough complexes are dominated by sedges, bulrushes, cattails and reed grasses. Grass-covered upland areas are few, with the most common species present being western porcupine grass, wheatgrass, rough fescue and needle-and-thread.

The diversity of landform and vegetation in the understorey of aspen forest provides habitat for a wide variety of wildlife species. Scattered aspen groves and blocks of native prairie around the fringe of this forest provide valuable habitat for white-tailed deer, Sharp-tailed grouse, and ring-necked pheasant which also utilize nearby agricultural crops. Predators like red fox, coyote, Swainson's and red-tailed hawks also do well in this area.

Extensive aspen of the Moose Mountain forest is the only area in southeastern Saskatchewan that provides important habitat for moose, elk and ruffled grouse. There is also a tremendous variety of song birds including species typically found in Eastern Canada.

Mixedwood Forest

The Boreal Mixedwood forest in Saskatchewan extends from the southeast to the northwest varying in width from 30 to 130 km. It is dominated by aspen stands on moderately moist, moderately well drained Orthic and Dark Gray Luvisolic soils, however, a large number of differing tree and understorey plant communities are found. These vegetation types and their associated understory species are best described based on the site moisture regime. There are 21 community types based mainly on moisture and nutrient regime.

Table 1. Community Types of the Boreal Mixedwood Forest (Adapted form Beckingham 1991)

Moisture Regime	Community	Nutrient Regime
1-3	Pine/Bearberry/Lichen	b
2	Grassland (Steep South Slope)	d
2-5	Pine-Black Spruce/Labrador tea/Feathermoss	b
3	Pine/Alder	b
3	Pine-Aspen/Cranberry/Aralia	b
3	Aspen/Rose/Peavine-Hairy Wildrye	c-b
4-3	Aspen/Buffaloberry	c-b
4-3	Aspen/Beaked Hazelnut-Saskatoon/Aralia	c-d
4-5	Aspen/Cranberry-Rose/Aralia	c-b
4-5	Aspen/Willow	c-d
4-5	White Spruce/Feathermoss	b-d

4-5	Oatgrass-Wheatgrass-Sedge	d
5	White Spruce/Dogwood/Aralia	c-d
5	Balsam Poplar-Aspen/Dogwood	c-d
5-6	Seepage Willow	d-f
5-6	Black Spruce/Labrador Tea/Moss	b-a
5-6	Tamarack-Black Spruce/Sedge/Moss	
	-rich	c-f
	-poor	a-b
5-6	Willow Shrubland (wetland)	c-e
5-7	Sedge Fen (Marsh reedgrass meadow)	d-f

Moisture regime		Nutrient regime	
1 2 3 4 5 6		a b c d e f g	
dry	wet	poor	high

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In general, the characteristic forest of well-drained uplands is a mixture of aspen, birch and white spruce. Balsam fir and balsam poplar occur locally on moist sites with balsam poplar found to be dominant on valley alluvium soils. Jackpine is dominant on well-drained sandy sites but also occurs with aspen and birch on some of the drier till-derived soils. Poorly drained sites and peatlands support black spruce and tamarack.

Forest Succession
In the Mixedwood Forest successional trends are either towards a white spruce or balsam fir "climax" on lowlands. The main community types are those dominated by aspen. This is due mainly to the occurrence of fire, which favours shade intolerant species such as aspen. The average fire rotation interval in the Mixedwood Forest is about 100 years.

Generally, tree canopy coverage increases as forests mature resulting in a gradual shift to more shade tolerant understorey species and a resultant decrease in herbaceous and browse yield. Livestock grazing in forested rangeland can also cause a download trend in understorey structure. Range condition assessment on forest rangelands therefore should reflect the grazing induced status of forage vegetation within different stages of forest succession. This is in contrast to the direct assessment of successional status for range condition such as that used in prairie rangelands.

Light and Understorey Structure
The primary factor controlling understorey structure in Mixedwood Forests is light.

Aspen is intolerant of low light intensities and tends to grow rapidly with a relatively open canopy. More light is able to penetrate aspen canopies as opposed to spruce and fir which have denser, longer closed canopies. The greater light penetration under aspen stands is likely the main reason for the taller and better developed shrub and herb understorey as compared to that beneath conifer canopies, although nutrient regime is also an important factor. Aspen communities are generally better suited to livestock grazing.

Grazing Response
Aspen community types are the most common and occur over a wide range of ecologically different sites. These different vegetation communities are identified primarily by understorey species. Within each community, livestock exhibit preference for certain species, due to palatability and availability factors. The designation as either a decreaser, increaser or invader is based on a comparison of grazed stands to ungrazed stands of the same vegetation type with similar canopy coverages. There are however a number of species with a similar response to grazing in all community types.

The Mixedwood Forest is the transition area between the forests of the Boreal Upland to the north and the agriculturally developed Aspen Parkland to the south. The rich forest diversity of hardwoods and softwoods with the lush understory in areas around Loon Lake and Hudson Bay contain the highest populations of moose and elk in the province. The Mixedwood Forest region supports the highest density and diversity of migratory song birds in Saskatchewan. Many winters in the tropical America's where rainforest clearing is threatening their long term survival.

Aspen forest wildlife is characterized by ruffed grouse, red-tailed and broad-winged hawks, snowshoe hare, woodchuck and white-tailed deer. Osprey and bald eagles are relatively common on lakes and rivers.

Forest predators provide the most dramatic impacts on livestock operations. Bears and wolves may prey on sheep and new born calves left in the open.

Response to Grazing

Decreasers	Increases	Invaders
Grasses	**Grasses**	**Grasses**
fringed brome	hairy wildrye	rough hairgrass
reedgrass	sheep fescue	Kentucky bluegrass
slender wheatgrass		smooth brome
awned wheatgrass		
rice grass		
Forbs	**Forbs**	**Forbs**
peavine	dewberry	silverweed
vetch	baneberry	Canada thistle
showy aster	sarsaparilla	sow-thistle
	bunchberry	dandelion
	pussytoe	absinth
	yarrow	
Shrubs		**Shrubs**
Saskatoon		bearberry
aspen saplings		alder
red-osier dogwood		balsam saplings
chokecherry		snowberry
hazelnut		twining
		honeysuckle

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Managing Saskatchewan Rangeland

Identification | Categories | Characteristics | Plant Growth | Physiology | Grass Morphology | Root Growth

Revised Edition

Identification

Learning to recognize range plant and their role in the ecosystem is a cornerstone of good range management. More than 1500 species of native plants have been identified in the prairie provinces.

All native range plants are valuable. They provide habitat for wildlife, stabilize watersheds, protect soil and enhance landscape beauty. About 150 species of the 1500 found on the prairies are considered important livestock forage.

There are three ways to learn plant identification - asking someone who knows, comparing specimens to labelled collections, using a plant key or a field guide. Visiting native rangelands with a trained person is the easiest method.

Gathering specimens for comparison with known samples provides not only plant names but a permanent collection that can be referred to year after year. Dried plant collections (herbaria) are located at the University of Saskatchewan, the University of Regina and Agriculture Research Stations.

Learning to identify plants using a plant key

Several plant keys are available to help identify plants using both vegetative (ie. leaves and stems) and reproductive parts (ie. parts of the seed head). The use of a plant key is discussed later, while several helpful related publications are listed at the end of the chapter.

Categories

Range plants are grouped by life form, life span, origin, growth season and response to grazing.

Life Form
Four broad groups of range plants are easily recognized: forbs, woody plant such as shrubs, grass-like plants and grasses. (See Diagram 3)

Forbs have non-woody stems and broad leaves with net-like veins. They are herbaceous and generally die back every winter. Many colourful wildflowers belong to this group. Prairie coneflower, golden bean and yarrow are examples.

Shrubs resemble trees, but have no definite trunk. They are woody plants that tend to branch out near the base and they grow shorter than trees. Shrub leaves are broad and net-veined, usually falling off in winter. Rose and snowberry are examples.

Grasslike plants resemble grasses, but have long solid stems which are either three-sided (sedges) or round (rushes). They have no visible stem joints and their leaves display parallel veins. Sedge leaves are three-ranked, while rushes have two-ranked leaves. Male and female floral parts are usually found in separate florets. Baltic rush and sun loving sedge are examples.

Grasses have jointed stems which are usually hollow. Their slender leaves, which display parallel veins, alternate in two rows on the stem. They have small green flowers that are usually complete, with male and female parts present on the same flower. Rough fescue, northern wheatgrass and needle-and-thread grass are examples.

Life Span

Perennials live three or more years, biennials two year, and annuals one year or less. Shrubs and trees are always perennials. Grasses, sedges and rushes are mostly perennials or annuals, with a few species being biennials.

Origin

Plants are either native or introduced. Most range plants are native, originating in North America.

Introduced plants are brought into North America from another continents or regions. Most seeded pastures contain introduced species. The majority are valuable for forage plants, but some have become troublesome weeds in native rangelands. Examples of introduced forage grasses include smooth bromegrass and crested wheatgrass.

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Growth Season

Cool-season plants display most of their growth in spring before warm temperatures arrive. They may grow again in fall if moisture is available. Cool-season plants produce most of the forage in Saskatchewan. Examples include northern wheatgrass and western wheatgrass.

Warm-season plants begin growth when soil temperatures rise in late spring, displaying principle growth in summer. They are well adapted to warm exposures, such as south facing slopes, where they photosynthesize at higher temperatures than cool-season plants. There are only a few warm season species in the province and they contribute a small amount to total forage production. An example is blue grama grass.

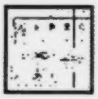


Diagram 3: The four range plant groups

Characteristics

Basic Parts

The basic parts of any plant are the roots, crown, stem, leaves and flowers. Plant parts have distinctive shapes, sizes and textures which differ according to the species. A magnifying glass is often needed to examine these parts, but plant recognition is simple once one becomes familiar with the various components.

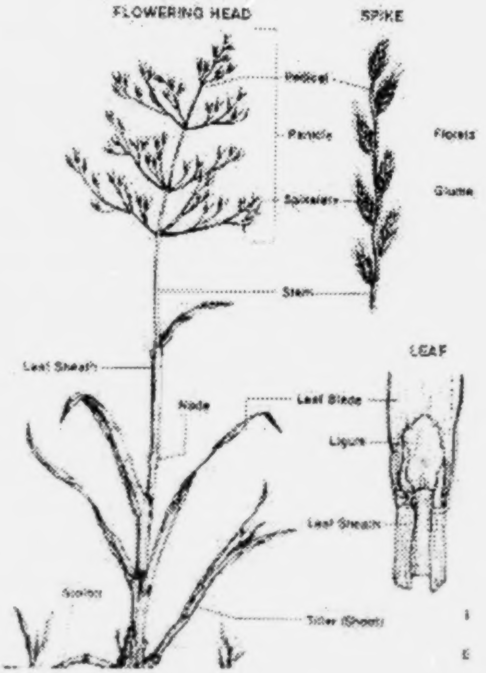
Grasses

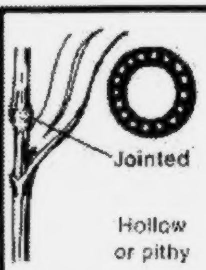
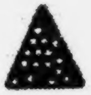
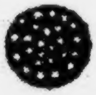
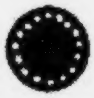
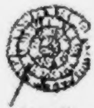
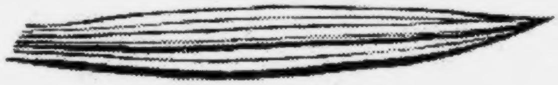
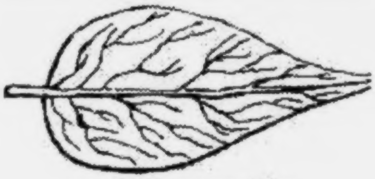
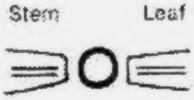
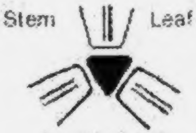
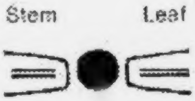
Most grasses look alike to the casual observer. However, grass plants have characteristics that set them apart as different species.

To identify grasses one needs to look closely at differences in color, height, leaf shape, stems, hairiness and seedhead. Presence or absence of ligules and auricles also provide important clues.

The above-ground parts of grass plants can be divided into categories: flowering and vegetative. Vegetative parts include stems and leaves. Grass stems are hollow, jointed and compressed or round. The joints, called nodes, are usually swollen. A leaf originates at each node.

Leaves alternate on opposite sides of the stem. Leaves have two



	Grasses	Grasslike		Forbs	Shrubs
		Sedges	Rushes		
STEMS	 Hollow or pithy	 Solid not jointed		 Solid	 Growth rings Solid
LEAVES	 Veins are parallel			 Veins are netlike	
	 Leaves on 2 sides of stem	 Leaves on 3 sides of stem	 Leaves on 2 sides of stem; rounded		

parts, the blade and the sheath. The blade is the portion that extends away from the stem. Leaf blades have distinctive shapes and textures which help to identify the species. The sheath is the portion wrapped around the stem.

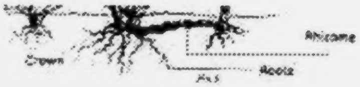


Diagram 4: Grass parts

The point where the sheath and blade join is called the collar. Here, a small membrane-like projection, the ligule, extends from the sheath. In some species the ligule is covered with a tuft of hair. Fingerlike appendages, called auricles, may also wrap around the stem at the collar.

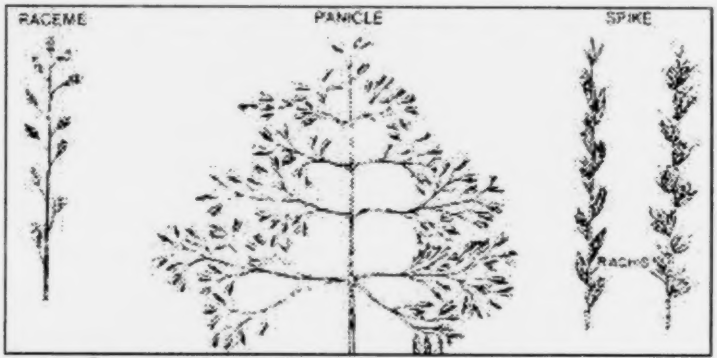
Flowering parts, known as the inflorescence, include the seeds and all their appendages. There are three main types of grass inflorescence: panicle, raceme and spike. The inflorescence contains smaller units called spikelets.

The panicle is the most common type of inflorescence. Spikelets are borne on branched stalks (pedicels). The panicle can be closed or spreading. Kentucky bluegrass and needlegrasses have panicles.

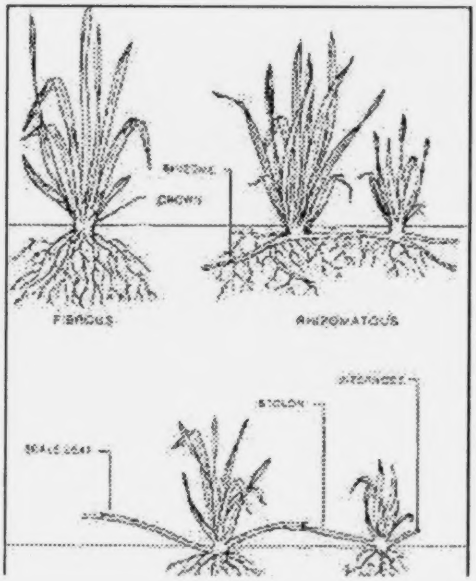
A raceme has spikelets borne on pedicels attached to the main axis. Little bluestem has a raceme inflorescence.

A spike has its floral parts attached directly to the main axis or rachis. Wheatgrasses and blue grama grass have spikes.

Spikelets are composed of florets, which are a grass plants flowers. The grass flower is not showy or coloured, and has no scent since it is wind pollinated and does not need to attract insects. The number of florets in a single spikelet varies from one, as in tickle grass, to 30 or more. At maturity each floret, if fertile, produces a seed.



Examples of a panicle, raceme and spike inflorescence.



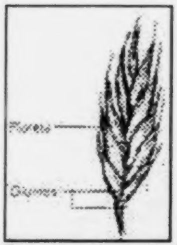
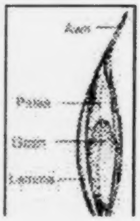


Diagram 6: Spikelet



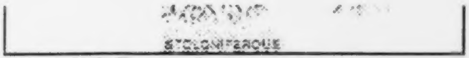

STOLONIFEROUS

Diagram 5: Types of grass roots

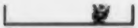


Diagram 7: Floret (seed)

Each seed is surrounded by two leaflike bracts called the lemma and the palea. Sometimes these bracts have hairs that allow the seed to cling to clothing or livestock. An example is northern wheatgrass.

Sometimes lemmas or glumes have sharp projections called awns which help the seed transport itself or "dig" itself into the ground. An example is western porcupine grass.

There are three different types of grass root systems: fibrous (as in "bunchgrasses" like needle and thread grass), rhizomatous (ie. smooth brome), and stoloniferous. Roots anchor the plant and supply water and nutrients from the soil. The crown is near the soil surface and produces new roots and shoots.

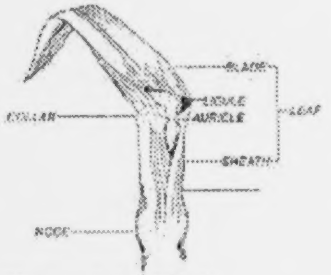

BLADE
LIGULE
AURICLE
LEAF
COLLAR
SHEATH
NODE

Diagram 8: Leaf Parts

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Forbs and Shrubs

Leaves of broadleaved forbs and shrubs are usually deciduous (falling off at the end of the growing season), or evergreen.

Leaf shape and arrangement on the stem can characterize broadleaf species. An opposite arrangement refers to leaves growing opposite each other at a node. An alternate arrangement has leaves alternating up the stem. If leaves are whorled, there are three or more leaves growing at one node (see Diagram 9).

Leaves are simple or compound. A simple leaf has only one definite segment between the stem and the blade end. A compound leaf has definite and distinctive segments, or leaflets. They may be pinnately (featherlike) or palmately (hand-shaped) compound (see Diagrams 10 and 11).

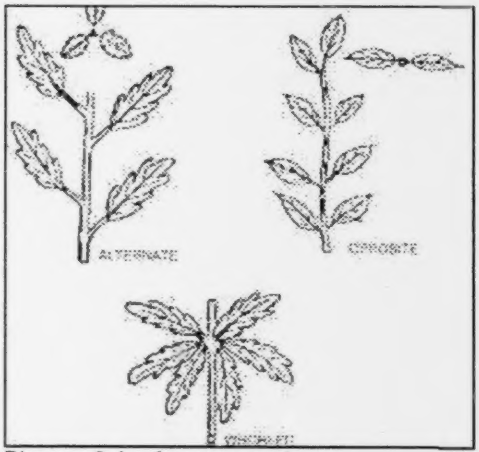

ALTERNATE
OPPOSITE
WHORLED

Diagram 9: Leaf arrangements.

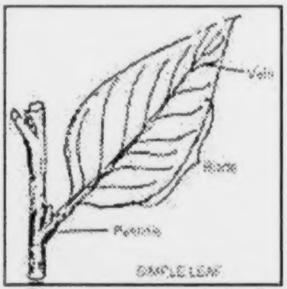

Vein
Blade
Petiole
SIMPLE LEAF

Diagram 10: Simple leaf

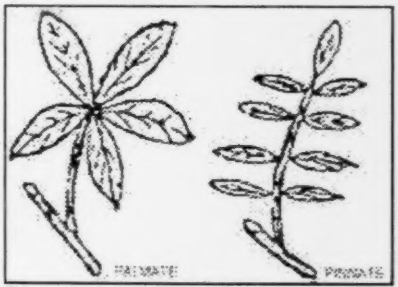
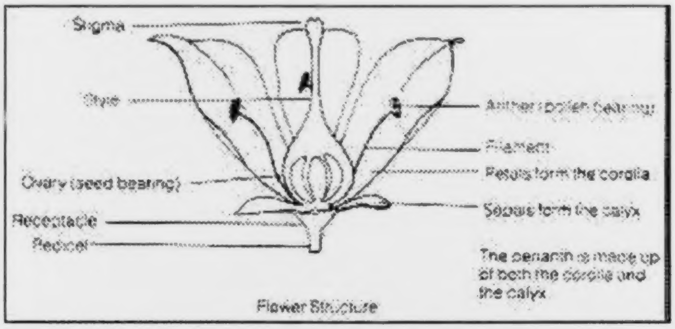

PALMATE
PINNATE

Diagram 11: Compound leaves


Stigma
Style
Anther (pollen bearing)
Filament
Petals form the corolla
Ovary (seed bearing)
Sepals form the calyx
Receptacle
Pedicel
The perianth is made up of both the corolla and the calyx
Flower Structure

A complete flower

The size, shape, color, hairiness and vein arrangement (venation) of a leaf blade are characteristics to look for when identifying forbs and shrubs.

Shrubs and forbs with easy-to-see flowers are usually easier to identify than grasses. Color and shape of flowers, as well as leaf and growth characteristics, are often sufficient for identification.

Typical parts of a complete flower are arranged in a circle. The most colourful and conspicuous ring is called the corolla, which consists of segments called petals. Below the corolla is a ring of cuplike sepals, known as the calyx. The calyx is usually green and protects or encloses the bud petals.

The clayx and corolla surround the male reproductive organs (stamens) and the female reproductive organs (pistils).

Names

All plants have only one correct botanical (scientific) name, but may have several common localized names. Botanical names allow universal reference to a particular species without any confusion.

Plants are classified according to family, genus, species and sometimes sub-species, or varieties. Each plant's botanical name reflects its genus and species.

Examples of three common plant families and some members follow:

Family	Tribe	Genus	Species	Common Name
Proaceae	Triticeae	*Agropyron*	*smithii*	western wheatgrass
(Grass)		*Agropyron*	*cristatum*	crested wheatgrass
	Stipeae	*Stipa*	comata	needle-and-thread
Rosaceae	*Rosa*	*woodsil*	wild rose	
(rose)	*Prunus*	*virginiana*		
chokecherry				
Fabaceae	*Medicago*	*sativa*	alalfa	
(legume)	*Oxytropis*	*campestris*	locoweed	

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Collections

One of the best ways to learn to identify plants is to collect, press and name them for reference year after year. Such a collection is a natural library of the species in a pasture.

Plants can be collected and pressed when the opportunity occurs and identified at a later date.

Plants should be gathered when they have produced seedheads, and before they begin to dry out and lose color. Select an average plant that is a representative sample, or collect several specimens showing the range of variation.

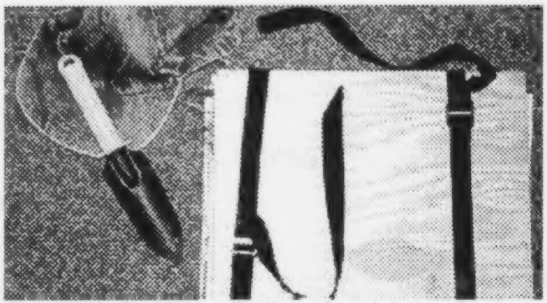
Each specimen should include some of the root system, flowering parts and fruit. Collecting flowers and fruit may require more than one specimen. Since plants differ in their growth seasons, collecting specimens can last from May until August.

Soon after every field trip, remove any root soil and arrange each specimen between newspapers or blotting paper. (Wilted or dried plants do not press well). Fold large plants to fit your equipment, making sure to display all parts. Include a note detailing the collection date and site.

When secure between the papers, place specimens in a plant press. Commercial models are available, but two pieces of plywood bound together with straps work well. If not pressed immediately, place the collected plants in a black plastic bag to prevent wilting.

Most plants dry within a week and can then be glued to a permanent background. Herbarium collections use background sheets.

Choose a convenient size suited to your purposes. Once the plant is affixed to its background, label the specimen and collection details for future use.



Some tools for plant collecting: shovel, hat and press

Plant Keys

A plant key is a series of alternative statements about the structure and appearance of a plant. Using a key requires a working knowledge of plant part terminology. A microscope, dissecting tools and ruler are very helpful.

Think of a plant key in terms of travelling a road that is a series of well-marked Y intersections.

From each pair of statements in the key, first choose the one that applies to the plant in question. Then proceed to the next appropriate pair and so on until the specimen is identified.

Two opposing characteristics are always given. Always choose the one that best describes the specimen. Read to the end of the line to determine the next set of characteristics or the name of the plant.

Do not skip down the key. Take each contrasting pair of statements in order. When a specific name for the specimen is pinpointed, check the selection with the description and illustration in the text to verify your findings.

A specimen used for keying should have all its parts if possible, including roots, stem leaves, flowers and fruit. While plant keys rely heavily on reproductive parts, some keys identify common grasses by vegetative characteristics (see Diagram 12).

Diagram 12: An example of a vegetative key for six common grasses

Paired True and False Statements:		
1. Sheath split and/or overlapping 1. Sheath not split, notched near top	2 Downy Brome	If sheath is split down front, go to paired statement 2. If grass sheath is closed down the front, this would be your answer. No need to go further
2. Auricles present	Western Wheatgrass	
2. Auricles absent	Go to paired statement 3	
3. Leaves folded in shoot at emergence	Go to paired statement 4	
3. Leaves rolled in shoot at emergence	Go to paired statement 5	
4. Ligule membranous, fringed with coarse hair on margin	Prairie June Grass	
4. Ligule a fringe of hair	Inland Saltgrass	

5. Ligule membranous, very conspicuous, spilt or fringed, to 4 mm long	Needle-and-Thread	
5. Ligule a dense fringe of hair, less than 0.5 mm long	Blue Grama	

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Plant Growth

Grass is the stockgrower's crop. Livestock, the saleable product, is a means of harvesting that crop.

An understanding of plant growth is the key to successful livestock production. Only then can grazing animals be used to manipulate grass crops to achieve economic goals.

Grazing management practices should be based on knowledge of plant physiology and morphology. Both physiological (functional) changes and morphological (external structural) changes affects forage quality and/or survival of the plant.

Physiology

Photosynthesis

Photosynthesis is the basic reaction in green plants that converts solar energy to chemical energy (see Diagram 13). It provides the energy for plant growth, maintenance and reproduction. In fact, this reaction is directly or indirectly responsible for all life on earth.

Diagram 13: Photosynthesis

Sunlight

Carbon Dioxide (CO_2) + Water (H_2O) --» Carbohydrate (food) + Oxygen (O_2)

green plant material

Water and nutrients are taken from the soil through plant roots. Carbon dioxide gas enters the plant through holes (stomata) in the leaf surface. Using sunlight energy, carbon, hydrogen and oxygen are combined to form carbohydrates.

The chemical pathway is very complex but the end result is a usable form of energy or "food": simple sugars which form the building blocks for all compounds. Plants use these building blocks for growth, reproduction and maintenance.

Converting raw materials to saleable product is the stockgrowers' business.

Carbohydrate production and Use

Carbohydrate manufacture, storage and use can be thought of as a factory, a warehouse and a consumer outlet. They interact as follows:

*when the factory (green cells in leaves and stems) produces more carbohydrate than is needed, some of the production is shipped directly (translocated) to the warehouse to be stored as starches for future use. Carbohydrates are produced only during daylight hours in the growing season.

* when factory production is insufficient to meet demands, current factory output is shipped directly to the consumer outlet as simple sugars. Carbohydrates ae also taken from storage to meet the growth demand. Plants can convert between the starch or sugar carbohydrate form quickly and easily according to need.

Growth always has priority over storage for carbohydrate use. There is a hierarchy for growth use. Newly forming leaves at growing point come first. Next in line are root growth, stem elongation, tillering and rhizome production. When flowering begins, these reproductive functions are given priority over other carbohydrate uses.

Carbohydrate storage organs include stems, crowns, roots/rhizomes and/or stolons. Bunchgrasses, such as crested wheatgrass or green needlegrass, store carbohydrates in slightly thickened stem bases. Creeping rooted grasses, like smooth bromegrass or western wheatgrass, have additional storage organs - the rhizomes by which these grasses spread.

Carbohydrate Cycle

An undisturbed perennial plant has a definite yearly cycle of carbohydrate manufacture, use and storage (see Diagram 14)

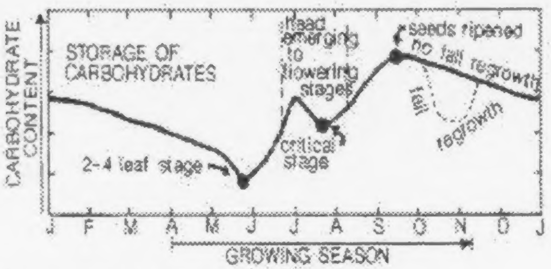

Diagram 14: Carbohydrate storage cycle

Starting in the fall with high levels of stored carbohydrate, reserves ae used during the winter to maintain plant cells and tissues. When temperatures warm up in spring, there is little or no green leaf area to produce energy directly, so more stored carbohydrate is used to initiate and expand new leaf area.

As a result, reserves drop dramatically in spring until the plant has produced enough leaf area to meet growth demands. As leaf area continues to expand during the growing season, reserves are gradually built up, until flowering and seed formation draw them down temporarily.

Reserves rise once again in the August to September period in preparation for winter dormancy.

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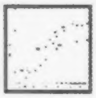
Grazing and Carbohydrate Levels

When all productive top growth is removed through grazing, the plant has no factory. It relies on stored carbohydrates to produce new leaf area. Reserve levels drop, and root growth and all other growth functions stop or slow until leaf area is restored.

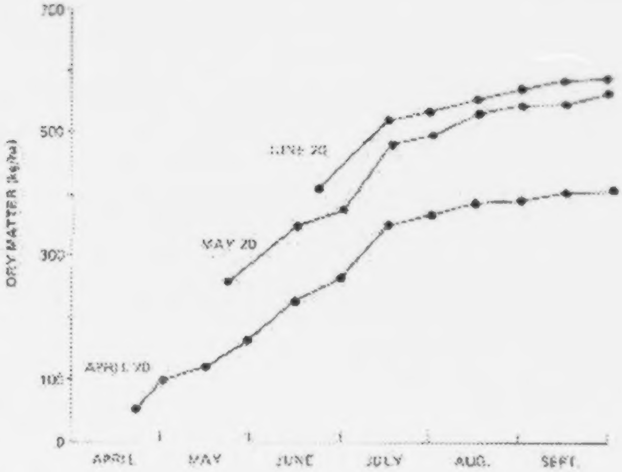
Uncontrolled grazing can deplete the plant's stored carbohydrates completely, ultimately leading to death. Particular attention must be paid to severe defoliation during spring and fall.

If the plant is grazed during spring growth before it has produced enough leaf area to obtain a positive carbohydrate balance, stored carbohydrates are quickly depleted. On prairie vegetation, annual native forage yield increases the longer grazing is delayed in May and June. Tests in which vegetation was clipped starting in April, late May or June showed that yield was highest when clipping was delayed until late June. (see graph 1)



Graph 1: Delayed clipping on forage yields.

Severe fall defoliation may lead to winter kill. Grazing should be adjusted to allow adequate growth and carbohydrate


DRY MATTER (kg/ha)
700
500
300
100
0
JUNE 20
MAY 20
APRIL 20
1
1
1
APRIL
MAY
JUNE
JULY
AUG.
SEPT.

storage prior to freeze up.

Close grazing through fall can result in a thinned, less vigorous forage stand the following year. A perennial plant that has been depleted of energy the previous year will produce less forage during the following growing season.

Close grazing of a dormant plant also removes valuable insulating and snow-trapping material. The living plant material is left with little protection against killing winter temperatures.

Managing Carbohydrates

Pastures are generally grazed during periods of active growth to optimize livestock performance. Both protein content and palatability are at an optimum. Although grazing reduces carbohydrate reserves, the impact is short-lived if grazing is not severe or season-long.

Carbohydrate removal from storage is not a problem as long as it is replenished. Grazing schemes that provide for non-use or rest intervals will allow leaf regrowth and carbohydrate buildup, and this is more desirable than the effects of season-long grazing.

Adequate carbohydrate reserves are best maintained by:

1. Delaying initial grazing on native range until mid to late June.
2. Keeping early grazing periods short.
3. Leaving adequate leaf area at the end of each grazing period.
4. Allowing adequate time between grazing periods for leaf growth and reserve buildup.
5. Allowing for adequate time and leaf area late in the growing season for reserve buildup and insulation.

Grass Morphology

Morphological changes occur in the grass plant throughout its development. These changes are easy to see and coincide with certain physiological changes that are impossible to detect visually. Morphological characteristics can be very useful when making grazing management decisions.

Grass Tillers

Vegetative reproduction of perennial grasses takes place through the production of new shoots or tillers. Each grass tiller arises from a growing point and has the potential to mature as an individual plant.

The growing point is where new cells develop. (Trees, shrubs and some forbs have growing points at the outer tips of their branches).

Grass growing points are found just above the last completed joint or node of each stem. In young grasses and in new perennial grass growth, the joints are crowded together near the soil surface. A leaf extends from each of these joints. There may be 10 to 15 joints in the first inch of the stem.

All grass tillers begin growth with a growing point developing from a dormant bud. As long as the tiller is vegetative, it has the potential to produce new leaves. A reproductive tiller can no longer produce new leaves.

Smooth bromegrass with new tillers developing

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Internode Elongation

As the growing season progresses, hormonal changes in the tiller cause the stem to push upward. The distance between the joints increases, that is, the internodes elongate.

The tiller first appears to be vegetative since no seedhead is evident. Elongation is often a transitional stage between the vegetative and reproductive stages of plant growth.

In some grasses, tillers remain in the elongated vegetative stage because the seedhead either never develops or aborts at a very young stage.

Continued Growth

Seed production does not mean the grass plant stops growing. Each tiller has dormant (inactive) buds located at the base of the tiller (basal buds), on the stem (aerial buds) and at the nodes on the stolons or rhizomes. Each dormant bud can produce a new tiller with a new growing point.

Basal, rhizome and stolon buds are generally the fastest source of regrowth. While active on some grasses such as reed canary grass, aerial buds are usually the least productive of the new tillers.

Removing an elongated tiller's growing point breaks the dormancy of the buds associated with the tiller. Growth of new leaves from an activated growing point can then occur.

Buds which remain dormant must survive the winter and produce next year's tillers. A spring tiller developing from a dormant bud can be compared to an annual plant developing from seed.

Perennial grasses must be allowed to manufacture and store sufficient energy to develop buds that are vigorous enough to survive the winter and begin spring growth. Later in the growing season, crown energy reserves increase and buds for next year's tillers develop. Consequently, severe grazing near the end of the growing season will reduce the production of crown tissue and cause a decline in forage output the following year.

Grazing and Tiller Growth

Early in the growing season all grass growing points are close to ground level. Since livestock cannot physically graze any closer than about an inch from the ground, there is no danger of removing the growing point at this time. Although plants are grazed, each grazed tiller continues to produce new leaf material. However, if internode elongation occurs, the growing point may be removed during grazing. If this happens, new leaf material must come from dormant buds (see Diagram 15).

Since a bud developing into a new tiller has no leaves, it must depend on energy provided by either remaining leaf material or storage organs. After severe leaf removal the only source of energy for new tillers is stored carbohydrates.

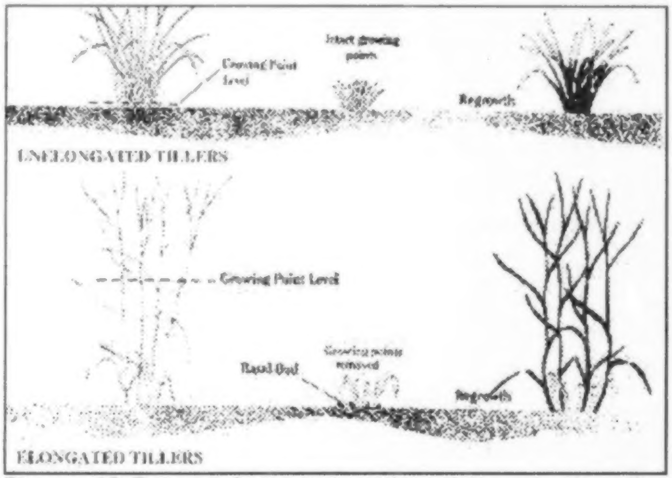


Diagram 15: Regrowth from intact growing points versus regrowth from basal buds.

The developing tiller draws down stored reserves. If sufficient time is allowed for new leaf material to develop and replenish the carbohydrate reserves, no harm is done. When severe grazing is repeated after an insufficient rest period, the plant starts to sacrifice root growth to produce leaves and is weakened.

If grazing is not severe, and sufficient leaf material is left, new tiller growth receives energy manufactured by the remaining leaf material. There is no depletion of carbohydrate reserves. In fact, removal of an elevated growing point, under proper grazing management and good growing conditions, can stimulate new vegetative growth, maintaining the plant in a healthy vigorous state.

Elongation Timing

The timing of internode elongation is important.

Kentucky bluegrass, June grass, green needlegrass, red top and many other grasses do not raise growing points until just before entering the reproductive phase. Growing points are maintained close to or below ground level for most of the growing season and are difficult to remove by grazing animals. These grasses are more resistant to season-long, close grazing.

Grasses such as smooth bromegrass, western wheatgrass and Canada wildrye elevate growing points early in their development. Smooth bromegrass, reed canary grass and western wheatgrass may have elevated growing points without seedhead development at certain times of the year. These species are more productive but are less resistant to grazing.

Proper Defoliation

Proper leaf removal can increase total production under suitable growing conditions.

Studies show that most native grass seed production is typically low and often erratic. Thus, vegetative reproduction (tillering) plays the major role in native grass survival. New tillers receive support from the original plant until their own root systems develop, minimizing adverse environmental effects.

To maximize forage productivity, range management practices should encourage vegetative reproduction with secondary consideration given to seed production. However, whole plant mortality can occur as a result of drought and other stresses and in the long term, seeds are needed to produce new plants to replace these.

Root Growth

Roots and underground stems account for more than half of a grass plant's total volume. Roots anchor plants in the soil and absorb water and nutrients. Underground stems, or rhizomes, enable plants to reproduce vegetatively and store carbohydrates.

Healthy root systems are vital for healthy plants. Grazing management, therefore, actually involves managing root systems in pastures and rangeland.

Root Replacement

Studies show that grass roots have relatively short lives. Since root replacement occurs rapidly, organic matter is constantly added to the soil.

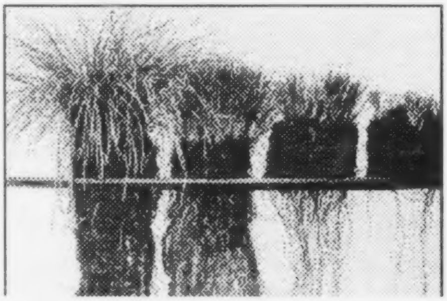
A healthy root system is vital to a healthy plant

Canada wildrye grass roots, for example, live no longer than three years. Only 45 percent of blue grama grass roots survive over three years.

Thus, except for large shrub roots, roots are not permanent fixtures and must be replace regularly. Replacement amount varies with species, but ranges form 20 to 50 percent of the total root system each year.

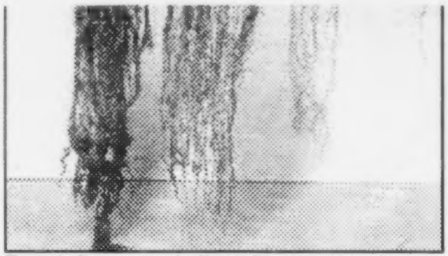
Leaf Removal and Root Growth

The amount of leaf removal directly affects root development of all grasses.



Plants respond to defoliation (clipping or grazing) by first stopping root and rhizome elongation. If grazing continues, plants react by reducing root numbers and diameter, branching and soil penetration depth.

The amount of reduction directly relates to defoliation severity and frequency.



Rough fescue sod clipped in the greenhouse at various heights every four weeks for five months. Left to Right: not clipped, clipped to 12.5, 7.5 and 3.8 cm. decrease in root volume is evident.

One study showed root growth stopping within 24 hours after leaf area removal of 40 percent or more. Another study showed that clipping 80 percent of the leaf area stopped root growth for 12 days, while removing 90 percent halted growth for 18 days. These roots did not resume growth until the leaves were again actively growing.

Removing 60 percent of leaves resulted in half of the roots ceasing growth. At 50 percent removal, almost all roots continued to grow actively.

This study was conducted under good growing conditions. Unfavourable soil moisture conditions after defoliation may interrupt root growth until the following year.

The degree of defoliation is usually more harmful to root growth than defoliation frequency. Taking a little of the plant more often is a better management strategy than taking all of the plant only once.

Since perennial plants are most common in Saskatchewan, the consequences of overgrazing are carried over from season to season. Continued overgrazing not only reduces the number, size and extent of underground plant parts, it causes changes in species composition that ultimately lead to poor pastures productivity.

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Managing Saskatchewan Rangeland

Grasses | Sedges and Rushes | Forbes | Shrubs | Poisonous Plants | References and Suggested Readings

Revised Edition

Grasses

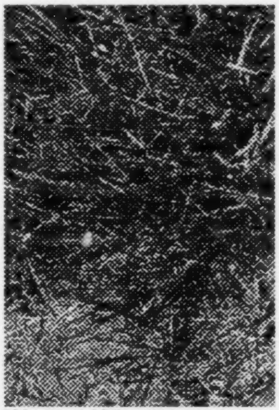
Northern Wheatgrass
Agropyron dasystachyum

Northern Wheatgrass

Life Span: perennial
Origin: Native
Season: cool
Auricles: often clawlike, clasping the stem, light green coloured
Ligule: inconspicuous
Blade: flat, ridged, slightly rough, green

An erect rhizomatous plant reaching heights of 40-70 cm. Most common wheatgrass of the prairies. Found with western wheatgrass of needle-and-thread on clay and loam soils, and occasionally in nearly pure stands on sandy land. A three-way root system makes it resistant to drought and invading weeds. Very dense, shallow root system penetrating depths of about 25 cm takes advantage of surface moisture, while a few deeper feeding roots reach depths of about 50 cm. Distinguished from western wheatgrass by its tufted basal leaves (persistent old leaf sheaths), lighter green color and pubescent lemmas. Palatable despite its fairly coarse stem and harsh leaves. Good forage for all livestock classes. Protein decreases from 16% in early May to about 4% by October. Digestible energy remains high at 45% from emergence to maturity. Varieties available for seeding ("Elbee").

Western Wheatgrass
Agropyron smithii



Western Wheatgrass

Life span: perennial
Origin: native
Season: cool
Auricles: often claw-shaped, usually clasping the stem, purplish colour
Ligule: inconspicuous
Blade: flat, prominently veined, very rough on upper surface, blue green coloured.

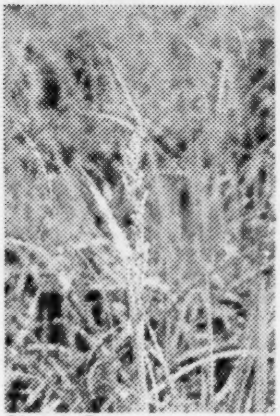
An erect, sod forming grass with long slender rhizomes. Found in fairly dense stands on clay soils in association with green needlegrass, on saline soils with salt tolerant grasses and greasewood, and in sparse stands among blue grama and needle-and-thread on upland sites. Rigid, blue-green leaves grow at a 45 degree angle from the stem. Well adapted to surviving drought and taking advantage of light rains. Rarely matures to seed stage, spreading by rhizomes. Fair yielding, palatable, nutritious and digestible. Cures well on stem. Varieties available for seeding ("Walsh" and "Rosana")

Slough Grass

Beckmannia syzigachne

Life span: annual or biennial
Origin: native
Season: cool
Auricles: absent
Ligule: Large, pointed, membranous
Blade: wide, flat, stiff

An erect, tufted grass forming large bunches from fibrous roots. Common in shallow sloughs and marshes. Prefers clay soils covered with a shallow layer of organic matter. A stout plant with shallow roots supporting a leafy stem that can reach 1 m in height. Branched head is a closed panicle. Seeds are sickle-shaped and hard-coated. Palatable to cattle and horses from early growth until seed is nearly ripe. Nutrients are well balanced, with seasonal protein levels constant, but slightly lower than upland grasses. Hay is light but of good quality.



Slough Grass

Blue Grama

Bouteloua gracillis

Life Span: perennial
Origin: native
Season: warm
Auricles: absent
Ligule: fringe of hairs
Blade: flat to loosely inrolled, sparsely hairy on upper surface, short and curly

A low growing, densely tufted, sod-forming grass. Most abundant in southern regions of the province. Flowerstalks reach 50 cm and usually carry two dark brown, sickle-shaped spikes with all flowers clustered along one side. Starts growth late in the season (about May 5th in southwestern Saskatchewan) and nearly two weeks later further north. Highly digestible, producing good forage for all livestock classes. Low forage productivity. Drought tolerant and resistant to grazing, it increases under heavy grazing and drought.

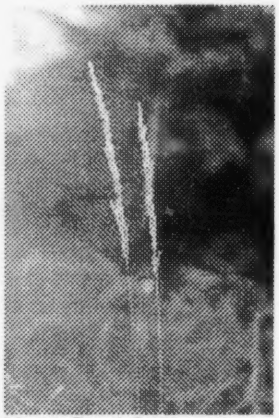
Blue Grama

March Reed Grass

Calamagrostis canadensis

Life Span: perennial
Origin: native
Season: cool
Auricles: absent
Ligule: prominent, pointed, often irregular of split
Blade: wide (6-10 mm), flat, lax, with a prominent mid rib

A tall, erect, tufted, rhizomatous grass. Most widespread of the reed grasses. A moisture-loving plant, growing in marshes, along streams and in moist shaded draws. Nearly pure stands are occasionally found in shallow northern prairie sloughs. Creeping rootstocks give rise to many coarse stems that may reach 1.5 m. Stems produce rough, lax leaves that may be 30-60 cm long. Develops nodding seedhead with upright branches close to the central column. Seeds are numerous, small and surrounded by a dense ring of hairs growing from the base. Palatability varies. Makes good hay if cut early in July.

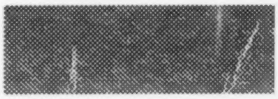


Marsh Reed Grass

Sand Grass or Prairie Sandreed

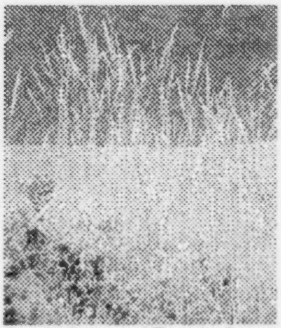
Calamovilfa longifolia

Life Span: perennial
Origin: native
Season: warm



Auricles: absent
Ligule: fringe of hairs
Blade: coarse, flat, smooth, light green, wide at base tapering to long fine point.

A tall, erect grass with sharp, long, scaly rhizomes. Grows on sandy prairie and sand dunes, along lakeshores and in open forests. One of the most important species in the Great Sand Hills, common in association with Indian ricegrass and sand dropseed. Roots extend to 1.5 m, but most found within 50 cm of surface. Surface roots dense, wiry and well adapted to hold sandy soil. Harsh basal leafage surrounds coarse, leafy stems which may reach 2 m. Palatable during first month of growth and after curing. Leafage eaten during both periods, seeds eaten in autumn. Stems rarely eaten. Despite heavy roots, susceptible to trampling and disappears where livestock congregate. Protein drops from 12% in May to about 4% in November, but available carbohydrates increase from 45% in May to 55% in October. Provides good winter pasture for maintenance livestock.


Sand Grass of Prairie Sandreed

Timber Oatgrass

Danthonia intermedia

Life Span: perennial
Origin: native
Season: cool
Auricles: absent
Ligule: fringe of hairs
Blade: flat or inrolled, often pubescent on lower surface

A short, tufted grass with fibrous roots. Most common of the five *Danthonia* species occurring in the Prairies. Grows in meadows and upland prairie close to tree line and on favourable sites within the spruce and pine zones. Common in the Wood Mountain, Cypress Hills and southernmost Parkland areas. A related species, Parry's Oatgrass (*Danthonia parryi*), is found only in the Cypress Hills. Produces an abundance of basal leaves and short, numerous stems. Four to 12 purplish spikelets form a closed panicle which clusters to one side. Flowering occurs in August with seed shatter in early September. Grazed by domestic livestock, deer and elk during spring growth. In overused rough fescue prairie it may form a solid stand after rough fescue has been grazed out, indicating that livestock prefer other grasses more than timber oatgrass.

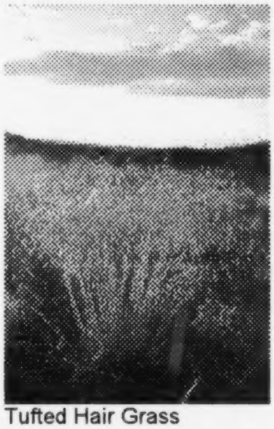
Timber Oatgrass

Tufted Hair Grass

Deschampsia caespitosa

Life Span: perennial
Origin: native
Season: cool
Auricles: absent
Ligule: very prominent, sharp pointed
Blade: to 5mm wide, contracted at collar

An erect, densely tufted bunchgrass with fibrous roots. Widespread and abundant throughout Canada. Grows sparsely in marshes or around shallow sloughs in drier prairie areas. Highly important species in permanently moist sites in the Cypress Hills. Seldom grows under trees. Dense, shallow roots support a mass of deep-green leaves. Folded leaves swell where sheath and blade join. Seedhead a feathery panicle with branches growing in whorls. Usually 2 seeds per spikelet. Good to excellent forage value for all livestock classes, and fair to good for wildlife. Protein content up to 18% in May decreases to 7% by August. Generally, a valuable range grass. Allow seed to set since plants may be short lived and may reproduce only from seed.


Tufted Hair Grass

Desert (Inland) Saltgrass

Distichlis stricta

Desert (Inland) Saltgrass

Life Span: perennial
Origin: native
Season: warm
Auricles: absent
Ligule: fringe of hairs, fused at base
Blade: stiff, rather short, somewhat awl-shaped, leaf collars bunched along stem and appear
opposite

An erect, short, sod-forming grass with extensive scaly rhizomes. Habitat includes moderate saline or alkaline soils, particularly around sloughs and saline flats. Male and female flower heads are on different plants, but both usually occur in the same clump. Palatability is low, with plants grazed only when better grasses are not available. Well-balanced nutrient composition supports fair to good livestock gains. An important grass for the prevention and control of saline soil erosion in Saskatchewan.

Canada Wildrye

Elymus canadensis

Canada Wildrye

Life Span: perennial
Origin: native
Season: cool
Auricles: to 2 mm, claw-like, and often clasping the stem
Ligule: short, not conspicuous
Blade: very wide (1-2 cm), flat, rough on upper surface

A tall, erect bunchgrass with short rhizomes. Grows in sparse stands on sandy soils, in woods, and along river banks, roadsides and other disturbed ground in the Prairies. Considerable basal leafage and tall stems leaf out from base to spike. Nodding spikes of about 15 cm long display two spikelets at each node, which is characteristic of wildryes. Eaten in spring but not very palatable. Forage value decreases sharply when mature.

Plains Rough Fescue

Festuca scabrella

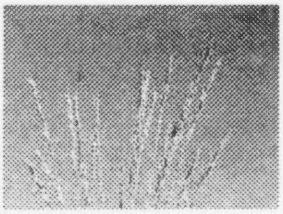
Plains Rough Fescue

Life Span: perennial
Origin: native
Season: cool
Auricles: absent
Ligule: membranous, short fringed
Blade: narrow, rough, flat to tightly rolled

An erect, tall, robust bunchgrass often with short rhizomes. Found on deep sandy-loam soils in the Dark Brown and Black Soil Zones. Dense, grey-green rough basal leaves provide most of the forage. Individual plants spread from tufts growing at the crown's edge. Very palatable, it is readily grazed out, particularly with repeated heavy spring usage. Plants are replaced by northern porcupine grass, needle-and-thread or weedy species. Spring protein is approximately 12 %. Cures well with digestible carbohydrates remaining high at all times. Best used as summer and winter range.

Hooker's Oatgrass

Helictotrichon hookeri



Life Span: perennial
Origin: native
Season: cool
Auricles: absent
Ligule: conspicuous, large, pointed

Hooker's Oatgrass

Blade: somewhat short, firm, to 5 mm wide, keeled with a boat-shaped tip

An erect, densely tufted, smooth-leaved grass with fibrous roots; found east of the Rockies from Alberta to Manitoba. Grows only where moisture is plentiful in open grasslands. Occurs in the Cypress Hills and Parkland areas. Seldom occurs in solid stands, rather, single plants are scattered among associated species. Rarely accounts for more than 5% of a stand. Densely bunched with a shallow root system and flat leaves. Awned seedhead a panicle with erect branches clinging closely to central column. Glumes appear shiny. Palatable, providing good forage.

June Grass

Koeleria cristata

June Grass

Life Span: perennial
Origin: native
Season: cool
Auricles: absent
Ligule: 1 mm, truncate and ragged
Blade: flat or inrolled, soft, sometimes pubescent

Long-lived bunchgrass. Found throughout open prairie and parkland regions but less common in open-bush areas. Often occurs as single plants in mixed communities rather than dense stands. Shallow, densely rooted plants, which rely on surface moisture, die back when subsurface moisture disappears. Leaves are short, flat, dark green and distinctly veined, sometimes with a few fine hairs near the stem. Almost leafless flowerstalks usually reach 20-30 cm. Closed-panicle seedhead resembles a small wheat or barley spike. Seed abundant but of low fertility. Palatable in spring, less so in summer. Preferred in late fall after curing. Protein content of 20% during early spring decreases rapidly to a low of 4% by November. Common but contributes little to total forage production. Increases in fair condition range, but declines as condition becomes poor.

Indian Rice Grass

Oryzopsis hymenoides

Indian Rice Grass

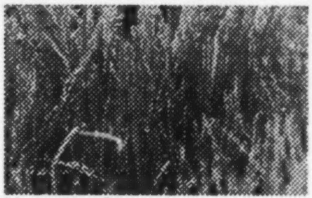
Life Span: perennial
Origin: native
Season: cool
Auricles: absent
Ligule: conspicuous, long, tapers to a point
Blade: long, slender, inrolled , smooth to touch

A tall, tufted, wiry grass with fibrous roots. Common on sandy soils and abundant in the Great Sand Hills. Old leaf sheaths located at base help protect numerous long, deep-green, folded basal leaves. Open feathery panicle white colour cause by light coloured chaff. Panicle always splits in two. Mature seed is black and surrounded with white silky hair. The awns readily breaks away from the tips. One of the most palatable native grasses, which has contributed to its disappearance. Cures well, providing nutritious grazing.

Kentucky Bluegrass

Poa pratensis

Life Span: perennial
Origin: introduced from Europe
Season: cool
Auricles: absent
Ligule: membranous, to 1 mm long, truncate, entire
Blade: leaf tips are boat shaped, somewhat keeled, narrow


Kentucky Bluegrass

Has invaded many grasslands and is also a common lawn species. Grows abundantly in the moister northern and eastern parts of Saskatchewan in native and seeded pastures where it forms dense sods. Leaves are mostly basal deep blue-green, folded or flat and slightly keeled. Leaf tips are boat-shaped; the mid vein appears as a double line or railroad track. Seeds are numerous with cobweb-like hairs at the base of the florets. Palatable and nutritious in early spring, protein content drops after seedheads form. Rhizomatous roots and good seed production make it a good competitor. Under poor pasture management tends to increase due to high tolerance to grazing and trampling. Unless irrigated, not high yielding in Saskatchewan. Pastures become less productive as Kentucky bluegrass increases in abundance.

Sandberg Bluegrass

Poa sandbergii

Life Span: perennial
Origin: native
Season: cool
Ligule: prominent, pointed
Sheath: compressed, pale to purplish at base
Blade: 4 to 12 mm long, flat or folded with boat-shaped tips

A small, erect bunchgrass with shallow fibrous roots. Found throughout the prairies but rarely very abundant. Leaves are numerous, fine, folded and mostly basal. Seedhead a closed panicle that is straw colored and shiny when mature. One of the first grasses to grow in spring, usually mature by early July with leaves withering into white clumps. Drought resistant, may spread during dry years as other less tolerant species die. Livestock avoid this species after mid-June as it is not very palatable.

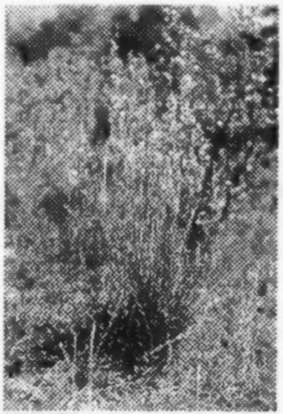
Sandberg's Bluegrass

Little Bluestem

Schizachyrium scoparium

Life Span: perennial
Origin: native
Season: warm
Auricles: absent
Ligule: membranous (1-3 mm), truncate, climate
Blade: 3-8 mm wide, short leaves along the stem, rough on upper surface, smooth below

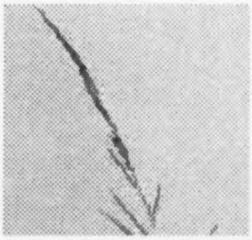
A bunchgrass producing many pith-filled stems that grow up to 60 cm tall. Dense stands common from the Interlake area of Manitoba to the Saskatchewan border. Small, sparse stands occur throughout balance of the prairies on sandy and gravelly soils with shallow water tables or where snow accumulates. Plants fairly common in most localities in the Great Sand Hills, throughout the Missouri Coteau, and along the South Saskatchewan and Frenchmen Rivers, and Swift Current Creek. Palatable early growth furnishes good forage for all livestock classes. After seed shatter, plants provide fair to good forage for cattle and horses. Plants often look ungrazed due to livestock pulling tender leaves out from around the bunch edge. A single, branched panicle tops each stem and produces the characteristic fluffy hair-covered awned seed. Plants develop a distinctive red tinge after frost.


Little Bluestem

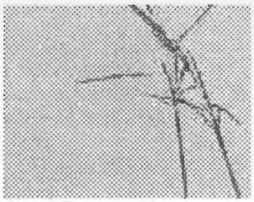
Sand Dropseed

Sporobolus cryptandrus

Life Span: perennial
Origin: native
Season: warm
Sheath: conspicuous tufts of long white hairs at cut throat and collar
Ligule: dense fringe of fine hairs



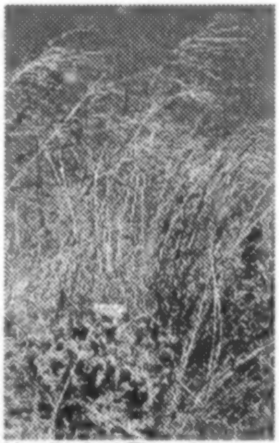
Blade: to 5mm wide, fine-pointed, stiff


Sand Dropseed

An erect or reclining, tufted, bunchgrass with fibrous roots. Sparse stands found in all sandy soil areas. Solid stems reach 1 m and base of plant is very coarse. Plants are moderately palatable. Starts growth about mid-May, matures seed before the end of July and becomes unpalatable when cured. Sheds seed before maturity. Protein content, which is only 10-11% in early summer, drops to 5 % by fall. Provides a higher fibre content than most other prairie grasses. Buried seeds are viable for more than 20 years.

Needle-And-Thread

Stipa comata

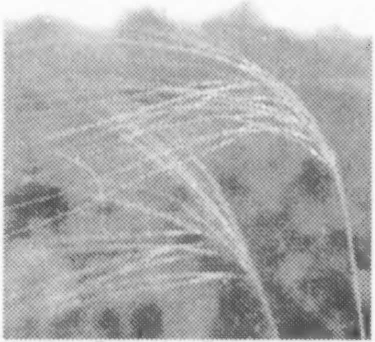

Needle-And-Thread

Life Span: perennial
Origin: native
Season: cool
Auricles: absent
Ligule: to 4 mm long, very conspicuous, pointed with a spit top
Blade: narrow, flat or inrolled, slightly rough

An erect, densely tufted bunchgrass that is one of the more important native species on the Canadian Prairies. The most common of the speargrasses. Seedheads grow from a stem that has a broad papery leaf (sometimes called the "flag leaf"). Panicles are loosely spreading and branched. Cylindrical, straw-coloured seed hull up to 12 mm long; awn is 20-25 mm long with one bend and a fine, long curly segment. Awns may cause mechanical injury to livestock. Seeds have a sharp, needlepoint callus at the lower end. Growth starts in late April and proceeds rapidly until mid-June. Flowering begins in early July with seeds maturing by early September. Forage value is good before awns develop and after the seeds drop. Palatable and drought resistant but can be grazed out with continual heavy use.

Western Porcupine Grass

Stipa spartea

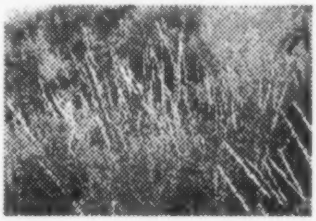

Western Porcupine Grass

Life Span: perennial
Origin: native
Season: cool
Auricles: to 10 cm, bent twice when mature, coarse
Ligule: to 3 mm, with a depression in centre
Blade: to 5 mm, flat

An erect bunchgrass. Usually the dominant species on loam soils in the central prairies. A related species, porcupine grass (Stipa spartea), is found only in southeast Saskatchewan and in Manitoba. Roots of western porcupine grass extend to depths of 1 m. Flowering stems are tall (40-60 cm), producing up to 30 sharp-pointed seeds in a feathery panicle. Mature seeds (12-15 mm long) have a 5-9 cm coarse awn which is bent twice. Palatable except between seed emergence and dropping. Nutritive and curing properties rate lower then needle-and thread but higher than porcupine grass. However, under equal conditions, western porcupine grass. However, under equal conditions, western porcupine grass is more palatable than needle-and-thread.

Green Needlegrass

Stipa viridula



Life Span: perennial
Origin: native
Season: cool
Auricles: absent
Ligule: hairy at the throat
Blade: up to 5 mm wide, flat, shiny on underside

Green Needlegrass

A tall, erect bunchgrass with a dense root system that extends to depths of 2-3 m. Found everywhere on the prairies, it seldom occurs in dense stands. Grows best on heavy clay soils in association with western wheatgrass. Leaves are long, green and mostly basal. Seedstalks can reach 1.25 m tall. Small, black, hairy seeds are produced in abundance. Lacks the sharp pointed callus of other needlegrasses. Weak awn is 2-3 cm long. The most palatable of the needlegrasses, plants are sought by livestock all season long. Spring protein content exceeds 20%, while fall content is about 8%. Tolerant to drought and moderately resistant to grazing. Cultivars have been developed and are marketed as "Green Stipa" or "Lodorm"

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Managing Saskatchewan Rangeland

Principles : The Forage Plant; The Grazing Animal | Concepts | References and Suggested Readings

Revised Edition

Principles

Range management can be defined as the art and science of producing sustained yields of livestock and wildlife while maintaining ecosystem integrity.

The four basic principles of range management, when followed, lead to increased livestock production, improved watershed and ecosystem stability. They are:

1. Graze range at the right time of year and to the right degree.
2. Leave adequate leaf area to ensure regrowth.
3. Allow each range unit time to be free of grazing animals during the active growth season.
4. Control livestock distribution and access to minimize selective grazing behaviour and prevent regrazing of plants.

Grazing can have long-term negative impacts it these principles are not followed. Poor management initially will lead to reduced plant vigour. Continued poor management will cause a loss of: valuable forage plants, drought resistance, ground cover and range productivity.

Cattle on native range too early in the season

Disruptions in the mineral and water cycles will also occur while the risk of soil erosion increases.

The Forage Plant

Beneficial Grazing Effects
There is a special relationship between plants and grazing animals. Grazing does the following:

Crested Wheatgrass is best used for early season grazing

1. Removes older tissue that is less efficient photosynthetically than young tissue.
2. Increases light intensity to lower, younger tissue.
3. Increases stomatal resistance promoting water conservation.
4. Increases forage production due to compensatory growth, is some cases.
5. Recycles nutrients available in urine and dung.
6. Speeds senescent forage breakdown by trampling.

In practice, plant response to grazing is complex and is related closely to genetics, environment, phenological stage, and intensity and degree of grazing. Grazing ceases to be beneficial when plant needs are compromised.

Seasonal Carbohydrate Storage
Non-structural carbohydrates (sugars and starches) are used as energy for plant growth and respiration. Carbohydrate

reserves are necessary for winter survival, early spring growth and regrowth after defoliation.

Non-structural carbohydrates are stored in stems, crowns, stolons, rhizomes, roots and leaves. Non-structural carbohydrates stored in roots are primarily used for root growth, while those stored elsewhere support above-ground growth and regrowth.

For non-structural carbohydrates to accumulate, photosynthetic production must exceed respiration demands. Defoliation removes photosynthetic tissue, causing the photosynthesis/respiration ratio to change. Stored energy must therefore be used to initiate regrowth. Defoliation which removes only some tilers from a plant, while leaving others, is less detrimental because no-structural carbohydrates may be transferred from ungrazed to grazed tillers.

Carbohydrate levels follow a seasonal pattern with a low occurring at the two to four-leaf stage, and maximum storage occurring after seed ripening. Grazing which is too early, too severe or at the wrong phenological stage weakens plants. Successful grazing systems take these factors into account.

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Root Growth

Root growth ceases within 24 hours of severe defoliation in many grasses and, in most cases, will not resume until the following year. Cessation of root growth places the grass plant at a competitive disadvantage with ungrazed plants.

Total Rest Doesn't Work

Protection from grazing often does not lead to the benefits one would expect. A British Columbia study estimates that sites in the Rough Fescue and Ponderosa Pine Zones would take 20 to 40 years to recover from fair to excellent condition under complete protection from grazing. Instead it suggests grazing during the dormant period to improve range condition.

In some cases fire may be required to return rangeland to its grass climax once shrubs dominate.

Proper Season and Degree of Use

Perennial grass plants must have sufficient energy reserves in the form of non-structural carbohydrates if they are to survive winter, initiate spring growth, and recover from defoliation. Carbohydrate reserves can be maintained by:

1. Deferring spring grazing until after the four-leaf stage.
2. Keeping grazing periods short during periods of rapid growth.
3. Allowing adequate time for regrowth between grazing events.
4. Leaving adequate leaf area to allow photosynthesis to continue.
5. Allowing adequate recovery time at the end of he growing season to enable the plant to store winter reserves.

Most grazing schemes attempt to maintain perennial grass production while preventing encroachment of annual grasses, weeds and shrubs. Many of the most desirable grass species are susceptible to prolonged grazing pressure and will decrease under sustained heavy use. Any decline in the amounts of these key indicator species signals that overgrazing is occurring.

Plants are damaged least by grazing that occurs at maturity or during dormancy. When grazing animals are forced to consume forage of low quality, however, their production declines. Animal performance is best when plant growth is at a maximum. Grazing management therefore involves maintaining an optimum balance between plant and animal requirements.

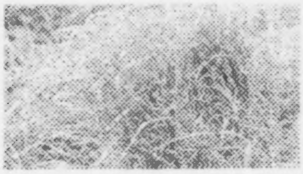
The Grazing Animal

Distribution

Livestock tend to favour streamside areas and avoid higher elevations, rugged areas and locations grater than one mile from water. Favoured areas soon become overgrazed, undesirable plants increase and forage production declines.

Most grazing management schemes aim to provide even livestock distribution and forage utilization over the entire range or pasture while preventing repeated selective grazing of plants. This may be achieved by herding, strategic fence placement, water development and salting under used areas.

development and salting under used areas.



Leaving adequate leaf area allows for faster plant recovery

Proper Stocking Rate
healthy range or pasture should have a good distribution of all age classes of perennial plants, as well as a mixture of species.

Overstocking and overgrazing leads to a reduction in palatable plant species and an increase in less desirable plants. Overuse also means that livestock must forage for longer periods of time to meet their needs.

Increasing grazing time by two hours per day will lead to significant reductions in cattle gain.

Even distribution and forage utilization is a range management goal.

Livestock Physiological Needs
Lactating cows and first-calf heifers have the highest digestible energy (DE) and crude (CP) demands. They should be placed on the best quality range.

Yearlings and steers have lower requirements and can be grazed on lower-quality rangeland.

Larger breeds require higher forage amount based only on body size. This is an even more important factor during lactation. Breeds producing more milk and larger calves have elevated energy requirements and may need supplementation or better-quality forage if they are to maintain milk production and be ready for re-breeding.

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Proper Animal Kind and Class
Different breeds and species of grazing animals exhibit distinct preferences for both forages and terrain. Continued use by a single herbivore species leads to a decline in preferred forage species.

For example, continued summer use by cattle or elk generally leads to a grass decline and an increase in forbs and browse on rangelands. Grazing by sheep or antelope places more stress on forbs, while use by goats and deer leads to a decline in woody species.

An over utilized area in a riparian zone.

Managers should select the kind of grazing program which best uses forage resources.

Concepts

Plant Response to Grazing
Range plants are classified according to their response to grazing as decreasers, increasers, and invaders. Their responses are complex, and depend on many factors including morphology, locations of growing points, phenology, palatability, weather, type of root system, competition from other plants and grazing history.

Decreasers are usually perennials that produce good-quality forage and dominate the climax communities.

Increasers are species that increase under moderate grazing use, but decrease under prolonged heavy overuse. Increasers are generally shorter subdominant members of the climax community.

Invaders are species that are not members of the climax community. They encroach on plant community as the range deteriorates.

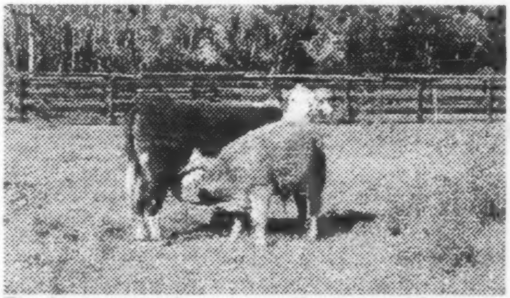
Proper Use Factors (PUF)

At one time the range manager's rule of thumb was to "take half and leave half of the current year's forage growth".

This rule of thumb is now being questioned, as the increased understanding of how plants grow and defoliation occurs.

A Proper Use Factor (PUF) is the percentage of utilization (for a species or range) deemed acceptable to allow improvement or maintenance of range condition. PUF are useful but difficult to apply because they do not deal with repeated defoliation of individual plants.

Plant species also vary in their resistance to grazing. Certain species can easily sustain themselves with 70 percent utilization, while other species may tolerate only 20 percent removal during the growing season.



The forage eaten by a cow-calf pair over 30 days is an Animal Unit Month

Even a low PUF does not eliminate over grazing. Under range conditions riparian areas often receive 100 percent utilization, while upland areas remain unused. Two groups of plants therefore exist: The overgrazed and the ungrazed.

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The Animal Unit Month (AUM)

The AUM is the amount of forage consumed by a 100-pound (450 kg) cow, with or without calf, in one month. Traditionally a figure of 840 pounds of dry matter per month (28 pounds per day) has been considered the norm. This 840 pound figure allows for losses to trampling, dunging, urinating and insects.

Stocking Rate

Stocking rate is the number of animals on a unit area of land during a grazing season. This is usually expressed in AUMs/acre or AUMs/quarter section. For example, a quarter section of land that grazed 10 cows for four months would have a stocking rate of 0.25 AUMs/acre or 40 AUMs/quarter.

Stocking Density

Stocking Density is the number of animals on a given area of land at any moment in time. For example, an acre of land grazing 50 head of cows for one day each year would have a stocking density of 50 head per acre on that day, but stocking rate of 1.66 AUMs/acre.

The following table provides conversions from AUMS per acre.

AUM per Acre	Acres per AUM	Acres for 6 Months
0.05	20.0	120
0.10	10.0	60
0.15	6.7	40
0.20	5.0	30
0.25	4.0	24
0.30	3.3	20
0.35	2.9	17
0.40	2.5	15
0.45	2.2	13
0.50	2.0	12
0.75	1.3	8
1.0	1.0	6
1.5	0.7	4

2.0	0.5	3

Carrying Capacity

Carrying capacity measures a range type's ability to produce a sustained forage yield, and thus to meet the requirements of the grazing animal. Carrying capacity is based on a safe utilization level of average annual forage production, as well as the plant community's grazing pressure tolerance.

Carrying capacity does not fluctuate yearly in response to forage production. Stocking rates, however, do fluctuate with weather conditions.

Carrying capacity and stocking rate are not necessarily the same.

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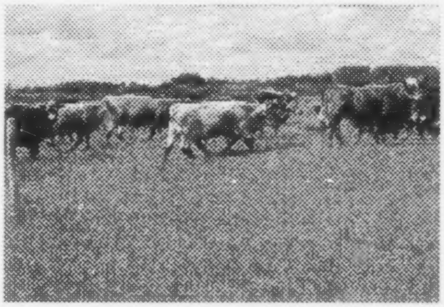

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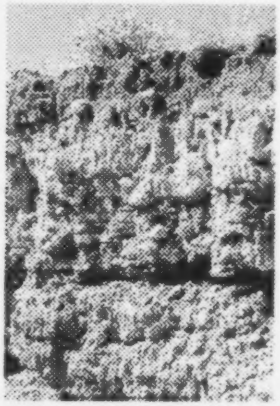
Managing Saskatchewan Rangeland

Range Site Concept | Range Site Condition | Using Range Site and Condition Information | Determining Range Condition and Trend | Monitoring

Revised Edition

Range Site Concept

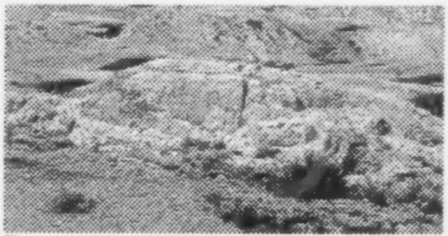
Effectively evaluating Saskatchewan rangeland begins with an understanding of the range site concept. Range sites divide rangeland into basic ecological units for study, evaluation and management.



A range site is a distinctive area of rangeland differing from others by its ability to produce a characteristic plant community. It is the product of all environmental factors responsible for its development. The major factors that interact to produce a distinctive climax plant community are climate, soil and topography.

The climax community is a relatively stable balance of plant species having evolved in the absence of abnormal disturbance. These species are adapted to their surroundings and survive within the environmental limitations of the area. Generally one or two species dominate and this does not vary from year to year.

Mineral recycling in a climax community is a maximum level and dominant plant species reproduce forever. Production may fluctuate yearly with climatic differences, but species composition changes very little.



Top and Above: A range site is a product of soil, topography and climate.

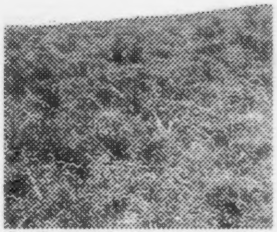
Range sites are distinguished by significant differences in the kinds or proportions of plants making up the climax community, significant differences in productivity, or both. Significant differences refer to requirement in changes in individual management factors such as stocking rate.

Boundaries between range sites may be distinct where changes in soil, topography, or moisture are abrupt, but generally are less distinct along boarders of environmental gradients.

Identification

Range sites are defined and described by soil texture, soil profile definition, soil (precipitation) zone and plant species composition.

For example, a range site is the Swift Current area may be an Orthic Brown Chernozemic sandy loam belonging to the Needlegrass/BlueGrama/Wheatgrass fasciation of the Mixed Prairie region. A range site in the North Battleford area may be an Orthic Black Chernozemic silty loam dominated by Rough Fescue and belonging to the Fescue Prairie region.


A climax plant community

Examples of descriptive range site names are loamy, silty, clayey, subirrigated and saline. Heavy soils can produce more forage and carry more livestock per unit area than coarse-textured soils. Likewise, subirrigated sites have greater production potential than dry upland sites. Salinity decreases the plant's ability to obtain water and essential nutrients, therefore reducing biomass production.

Topography is also an important influence in determining the climax plant community. Features such as elevation, slope, exposure and landscape position affect run-off and run-on water, evaporation, temperature and other factors that influence which plants grow and the amount of production.

For example, two sites may be in the same precipitation zone and have the same soil type, but support extremely different plant communities because they are on opposite sides of a hill.

Northern exposures tend to have lower evaporation rates, lower temperatures and higher soil moisture than southern exposures. The environment on the north side of a hill typically produces more vegetation and has a different plant species composition than the south side.

Range Site Versus Management Unit
Range sites should not be confused with management units.

A management unit is created by fencing a field or pasture. Management decisions concerning that particular parcel of land can be made regardless of what is happening across the fence.

Several range sites may exist within one management unit. Or depending on fence line placement, a range site may be divided between two management units part on one side of the fence, part on the other side.

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Range Site Condition

Just as the range site defines capability or potential, its condition indicates the status or health of the present plant community in relation to the potential, or climax.

Range condition expresses changes in vegetation composition, productivity and land stability. Condition is divided into four classes; Excellent, Good, Fair and Poor, depending on how far the present plant community is from its potential. These ratings are not the same as forage values and do not necessarily indicate the nutritive value or palatability of species present on a range site.

The relative contribution of each of the three plant categories (decreasers/increasers/invaders) to the composition of the range site determines its resent condition rating.

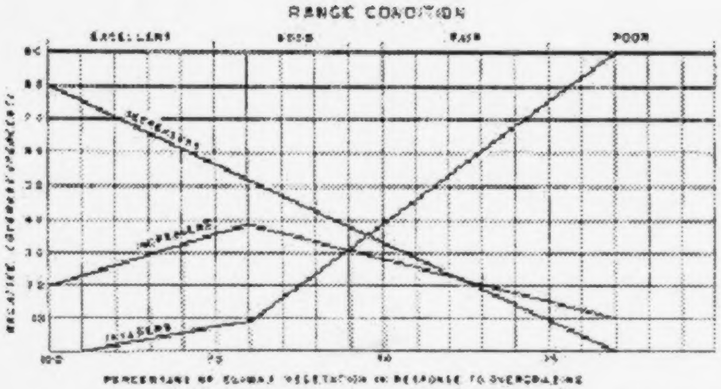
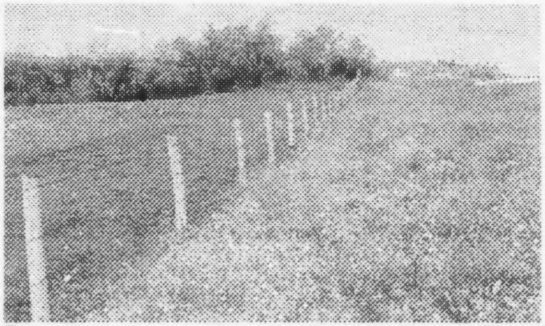


Diagram 16: relation of Decreasers, Increasers and Invaders on Rangelands.

The relative contribution of each of the three plant categories (decreasers/increasers/invaders) to the composition of the range site determines its present condition rating.

Many influences can modify or temporarily destroy vegetation, but do not necessarily eliminate recovery of the potential plant community. Unless the disturbance is particularly severe or prolonged, the site potential is not permanently affected and the site itself remains capable of supporting the climax community.

In Saskatchewan , for example, range is often considered in poor condition due to drought. This is an inaccurate assessment because range does not decline in condition quickly. Forage production may be temporarily less due to drought, but the range condition is not changed and the plant community composition is likely not altered.



Fence line contrasts show changes in range condition due to grazing pressure.

Remember, range condition refers to the health of the rangeland, not its annual production.

Deterioration Signs of Native Range

Plant vigour decline and loss of surface litter are the first warning signs of range deterioration. This is followed by a shift in species composition, the change most easily measured and the main contributing factor to other changes in the site.

Deterioration of the plant community causes loss of organic matter, soil fertility, ability of the soil to absorb and retain water, as well as exposure of surface stones. This reduces the opportunities for establishing the original plant community and productive capacity of the site.

Severe deterioration may significantly alter the potential productivity and plant community. A different range site with a much lower potential must then be recognized and managed accordingly. A reduced stocking rate, for example, is one necessary management change.

Monitoring helps producers determine range condition

Tame Pastures

With tame pastures where the native vegetation has been removed, traditional rangeland assessment cannot be used to rate condition. However, there are signs that indicate deterioration of tame grass stands.

The natural tendency and in any plant community is to move towards a higher successional stage. Nature attempts to replace tame forages with either weedy or native species adapted to the site.

Reduced productivity, increased bare ground or the formation of dense sod are the first visual signs of tame stand deterioration. Replacement an encroachment by increaser and invader species soon follow. For example, crested wheatgrass may be replaced by an increaser such as fringed sage or an invader like Russian thistle.

Eventually other site characteristics deteriorate. Erosion becomes evident, the soil absorbs and retains less water, and site fertility drops.

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Using Range Site and Condition Information

Range site and condition information are useful when developing an inventory for range management purposes.

The inventory of available resources is a simple but often overlooked aspect of the planning process. Whether on public or private land, this inventory is the basis for developing and applying management decisions.

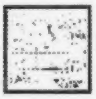
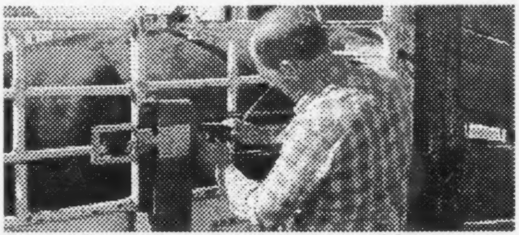


Diagram 17: Sample Range Map.

Decisions to maintain, improve or, in rare cases, degrade the present range condition are based on overall objectives. Areas to reseed, rest, prescribe burn or fertilize are mapped out. Stocking rates, season of use, and kind and class of grazing animals are tools used to achieve objectives based on the site and condition inventory.

Range trend information is also useful. While range condition reflects the health of the range at any point in time, trend measures change in condition over time. This is accomplished through yearly determinations of range conditions on the same area. Trend is referred to as improving, declining or stable.

Range trend details provides a basis for management adjustment. If condition is not moving in the desired direction, management needs to be altered. Continued evaluations of range trend are used to measure the effectiveness of applied management.



Record livestock numbers, classes and forage requirements, as well as livestock performance, in the inventory.

The Inventory

Taking stock of the land base and determining its potential as compared to actual production is the first step in developing an inventory on which to base management decisions.

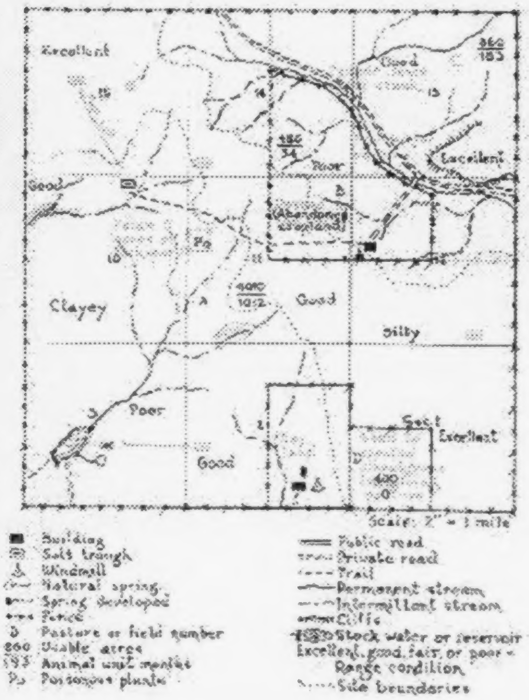
An inventory of the forage resource base should include:

1. A pasture map showing vegetation boundaries and soil types.
2. Range condition and forage production of native units.
3. Species, age and production of native units.
4. Topographic features.
5. A record of past use including season of use and stocking rates.
6. Potential problem areas (weedy and poisonous plants).
7. Areas requiring special treatment because of wildlife or watershed concerns.
8. Hay production.
9. Crop aftermath.

"OVERLAY"

This shows how to "hang" your plans for the following:

Fencing
Salting placement
Stock water development
Range reseeding
Trail building


Excellent
16
14
Good
360
183
15
486
54
Poor
Excellent
Good
Abandoned cropland
Po
10
11
12
Clayey
4
4000
1012
Good
Silty
3
Poor
2
Good
Salt
Excellent
400
0
Scale: 2" = 1 mile
Building
Salt trough
Windmill
Natural spring
Spring developed
Fence
Pasture or field number
Usable acres
Animal unit months
Poisonous plants
Public road
Private road
Trail
Permanent stream
Intermittent stream
Cliffs
Stock water or reservoir
Excellent, good, fair, or poor - Range condition
Site boundaries

Tally livestock numbers, classes and forage requirements to determine forage demand for each year. Compare them to actual amounts of forage produced through the year, this should include carry-over hay. This helps determine where shortages are. In many cases, livestock production is severely restricted by shortages during critical periods, while apparent forage excesses occur at other times.

List physical improvements such as fences, handling facilities, dugouts, wells and equipment. Mark fences, salting areas and water sites on a map or aerial photo.

List all equipment including age, condition and replacement value.

List manpower availability and identify training needs.

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The following eight tables illustrate how to determine your forage balance.

Table 1. Stocking rates in AUMs/acre for loam and clay upland sites.

Soils Zone	Range Condition			
	Excellent	Good	Fair	Poor
Brown (dry)	0.25	0.20	0.15	0.10
Brown (moist)	0.35	0.25	0.20	0.15
Dark Brown	0.45	0.35	0.25	0.20
Black	0.55	0.44	0.33	0.24
Grey	0.40	0.30	0.20	0.15

Table 2. Stocking rates in AUMs/acre for cultivated pastures

Species	Soil Zones			
	Brown	Dark Brown	Black	Grey
Crested wheatgrass	0.5	0.67	1.0	1.0
Russian wildrye	0.5	0.67	0.75	N/A
Brome/Alfalfa	N/A	0.75	1.2	1.2

Table 3. Suggested reduction in cattle carrying capacity according to percentage slope

% Slope	% Reduction in Carrying Capacity
0 - 10	No Reduction
11 - 30	30
31 - 60	60
over 60	100 (ungrazable)

Table 4. Suggested reduction in carrying capacity according to distance from water.

Distance from Water (km)	% Reduction In Carrying Capacity
0 - 1.5	None
1.5 - 3	50
3	100 (ungrazable)

Table 5. Animal Unit Equivalences for species on a body weight basis.

Animal Species	Weight (lbs)	AUM Equiv.	Forage Dry Matter (daily lbs)	No. Per AUM
Cow	1000	1.0	28.0	1.0
Cow	1500	1.5	42.0	0.7
Heifer	700	0.7	20.0	1.4
Bull	1500	1.5	42.0	0.7
Horse Dry	1000	1.4*	38.0	0.7
Horse Dry	1400	2.0	53.0	0.5
Sheep	120	0.2	4.4	5.0
Antelope	120	0.2	4.4	5.0
Deer	160	0.25	5.5	4.0
Bison	1500	1.5*	42.0	0.70
Elk	600	0.7	15.0	1.4
Gopher	1	0.0006	0.12	177.0
Jack Rabbit	7	0.024	0.5	42.0

Table 6. Forage Inventory for a hypothetical range in South West Saskatchewan

Forage Class	Acreage	Lbs/ac Avail	Yield	TDN	Lbs/AUM	AUMs
Native	3200	230	736,000		660	1115
Tame Pasture	340	660	224,000		660	340
Hayland						
Hay	220	2000	440,000	0.50	400	550
Aftermath	220	250	55,000	0.50	660	83
Cropland						
Grain	80	1440	115,200	0.75	400	216
Aftermath	80	320			660	38
Total AUMS						**2342**

Table 7. Stock numbers chart. Average cow wt. - 1200 lbs, Bulls wt. - 1800 lbs, Heifer wt. - 1000 lbs.

Month	Cows	AUMS	Heifers	AUMS	Calves	AUMS	Bulls	AUMS	Total
Jan	100	120			40	32	09	17	169
Feb	100	120			40	32	09	17	169
Mar	100	120			40	32	09	17	169
Apr	100	120	20	20			09	17	157
May	100	120	20	20			09	17	157
June	100	120	20	20			09	17	157
July	100	120	20	20			09	17	157

Aug	100	120	20	20	96	48	09	17	205
Sept	100	120	20	20	96	48	09	17	205
Oct	100	120	20	20	96	48	09	17	205
Nov	100	120			40	24	09	17	161
Dec	100	120			40	24	09	17	161
Totals									**2072**

Table 8. Feed Balance in AUMS.

Month	Grazing	Grain	Hay	Aftermath Avail.	Req. Balance		
Jan		50	127		177	169	+08
Feb		50	127		177	169	+08
Mar		48	127		175	169	+06
Apr		48	127		175	157	+18
May	170				170	157	+13
June	170				170	157	+13
July	223				223	157	+66
Aug	223				223	205	+18
Sept	223				223	205	+18
Oct	223				223	205	+18
Nov	223				223	161	+62
Dec		20	42	121	183	161	+22
Totals	1455	216	550	121	2342	2072	+270

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Determining Range Condition and Trend

The first step in rangeland evaluation is to describe the current plant community. Many methods exist to determine the plant species composition of a range site.

No one method gives a complete picture because each evaluates different features of the plant community. A measure of plant numbers, amount of cover or plant weight is usually taken using a quadrat, plotless or line intercept technique. A discussion of the more common methods follows.

Frequency
Frequency refers to how often a plant occurs.

A plant species is rated as present or absent within a quadrat - the number of plants of each species is not counted. Several quadrats are used to gain a good understanding of the plant community. The number of quadrats in which the plant occurs is divided by the total number of quadrats observed to obtain the frequency value.

For example, if western wheatgrass is found in 60 of 100 quadrats, it has a frequency of 60 percent. If June grass is found in only 20 of the 100 quadrats, it has a frequency of 20 percent for that range site.

Frequency measurements allow for rapid collection of objective data since plants are either absent or present. Frequency also tends to give more complete information on a species because a larger area is studied compared to other methods.

However, frequency measures do have some disadvantages, particularly if plants are not evenly spread out. Frequency of each species must be studied separately. A total value for all species has no meaning as it does for plant cover or production methods

A Daubenmire frame, an example of a quadrant, is used to measure cover.

Cover

Cover measurements are relatively easy to undertake and complete with consistency. Vegetation cover is a good indicator of the ecological importance of a species. Ground cover gives a good measure of site protection.

Vegetation cover measures the amount of above-ground material relative to ground area. It is usually expressed as a percentage.

Daubenmire Frame

Using a Daubenmire frame (20 cm wide and 50 cm long) is one way to accurately and quickly estimate cover percentage. Constructed of a sturdy material, rebar for example, the frame sides are painted red and white to help mark area percentages.

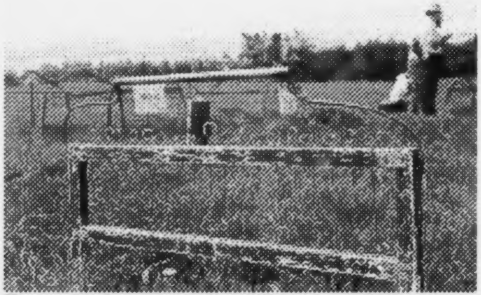
Canopy cover by species is ranked in each frame as follows:

Rank	Cover %	Midpoint of Class %
1	0 - 5	2.5
2	5 - 25	15.0
3	25 - 50	37.5
4	50 - 75	62.5
5	75 - 95	85.0
6	95 - 100	97.5

Using ranks simplifies the measurements. It is easier to decide if a species falls within a certain class than to estimate exact cover percentage.

When measurements are complete, the ranks are multiplied by the midpoint of the class cover percentage and averaged. The result is an estimate of the amount of space each species occupied, with the total coverage in the plot often exceeding 100 percent. Canopies of different species commonly interlace and plants of different heights often overlap.

This method of estimating canopy cover is accurate enough to use year after year to track any changes in the plant community. However, the information gathered does not show how any changes resulted, or differentiate between an increase in the size of a large plant or the growth of seedlings. To determine this information, a map detailing the size and location of each plant in the study plot is required.



The point frame can be utilized in rangeland monitoring.

Point Sampling

Point methods of sampling are another way to measure cover. They are based on the quadrat being reduced to a dimensionless point. If enough points are distributed over an area, then the percentage of points directly over a species gives an unbiased measure of both actual and relative percentage cover for that species.

Range managers generally use the step-point variation for rapid surveys. A point is marked, or a notch is cut, on the toe of a shoe. The observer then paces a straight line across the sample area, and at regular intervals, records 'hits' under the point. Visual sightings are adequate, or a pin can be used to decrease the amount of bias.

Some important advantages and disadvantages of point methods are:

1. In sparse vegetation, a very large number of points is required to obtain good individual species estimates.

2. Point methods are best suited to low growing vegetation. Recording hits on tall species requires the observer to project the point upward. This is difficult to do in an unbiased manner.
3. Recording leaf hits on windy days is difficult.
4. Cover is overestimated if the point size is increased. It must be kept almost dimensionless.
5. In the step-point method, bias may be introduced if observers deliberately or subconsciously lengthen or shorten their pace or deviate from a straight line to avoid obstacles.

There are various other cover measurement techniques. Most were developed for specific needs are not widely used.

Production (weight)
Plant material weight is an important characteristic of range vegetation. It is good measure of site productivity and species ecological importance. Carrying capacity is directly related to production.

Root development is a measure of plant health.

Production is the total weight of plant material produced over a period of time, while productivity is the rate of production over a specified period of time.

The actual techniques for measuring weight are straightforward, but time-consuming. The most important considerations are what to measure and when to measure it.

Carrying Capacity Indicator
Range managers usually measure plant weight as an indication of site productivity or carrying capacity.

To measure production in a given year, separate the old material from the current year's growth. Last season's growth may still be attached to perennial grasses and forbs. Measuring this material overestimates current production. On shrubs, measure only the leaves and shoots produced during the current year.

Using production to estimate animal carrying capacities involves understanding the distinction between total plant growth and forage production. Forage is the portion of plant growth that animals can and will eat. It depends on the palatability of the plant or plant part, the acceptable utilization level and the accessibility of the plant material.

Harvest Method
Clipping and weighing plots is the most straightforward method for measuring production. The standing crop is cut off at ground level or some predetermined level above ground, old growth is separated from the new, and the sample is weighted. Weighing can take place in the field with subsamples measured for moisture correction, or the whole sample can be dried and weighed later.

Dry Weight Basis
Moisture content of plants, particularly the green portions, varies widely depending on the plant part, season of year, current soil moisture and time of day. Thus plant weight is generally reported on a dry weight basis.

Samples should be oven-dried or air-dried before weighing. If air-drying the samples, a subsample should be taken and oven-dried to determine a moisture correction factor.

Limitation
Production is usually measured at the end of the growing season. This is when peak total production already should have occurred. After this time, a net decrease in plant material present will occur.

Although it is the best practical method of estimating total production, there is a serious limitation to this one-time measurement. It does not account for losses during active plant growth.

During the growing season materials are transported below ground, respiration losses occur, wood is laid down on old stems, leaves and reproductive structures wither and die, and production is consumed by insects, birds, mammals and fungi. The underestimation of total production may be slight or it may range up to 50 percent of the true value.

If the range has been or is being grazed by livestock or other animals when production is measured, then the areas used for measurement need to be protected by cages or fences of some type. Plant regrowth after grazing is another possible source of error.

Measuring production for one year is not a good indication of the average annual production. Annual production is significantly influenced by rainfall.

Production in good years may be two to five times that of poor years. Serious problems arise if carrying capacities are based only on measurements made during good years.

Monitoring

All of the methods above will give an indication of range condition or production at a given time. It is not enough to quit here, the next step is to monitoring. One site measured continually over several years will provide more decisions are affecting the area. Monitoring also allows a basis for future decisions to be made.

Monitoring includes methods discussed above.

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Monday, December 11, 2000

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Managing Saskatchewan Rangeland

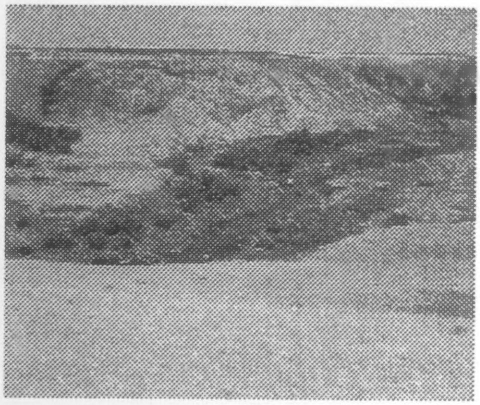
Grazing Patterns | Forage Selection | Grazing Duration | References and Suggested Readings

Revised Edition

Grazing Patterns

Most animal problems attributed to livestock grazing can be traced to behaviour.

Grazing animals are creatures of habit, using the same areas year after year, after leaving as much as 65 percent of the available pasture untouched. Herds will also establish home ranges and will rarely deviate from them.



Cattle reluctantly graze steep slopes

Cattle reluctantly graze on slopes exceeding 15 percent and, in rolling terrain, rarely feed at elevations grater than 70 metres above water. They are also limited by horizontal distance from water, rarely grazing further than 2.5 kilometres from it.

However, greater travel distances cause an increase in energy expenditure.

Sheep utilize rugged terrain better than cattle. Sheep show more reluctance to graze areas having natural predator cover, such as bush or topographic relief. They will walk from three to five kilometres for water. Again, travel distance has a significant influence on production.

Cattle requires an average of 40 to 50 litres of water per day. This varies greatly, however, and studies show cattle may require up to 150 litres per day in hot weather and dry forage conditions.

Sheep need from 7.5 to 10 litres of water per day. Horses require from 60 to 75 litres per day.

Livestock seek shade during hot summer periods, resulting in excessive usage of forest and riparian areas. Livestock usually overuse dry southern exposures early in spring and then switch to riparian and shaded areas during hotter times of the year. North facing slopes usually remain under utilized.

Range usage is affected by livestock grazing of shaded areas.

Range improvements and grazing systems attempt to control livestock behaviour. Fencing, salting, herding and water development lead to more uniform livestock distribution. Systems are designed to control timing, intensity and frequency of grazing on individual plants.

Good Grazers
Certain cattle breeds are better adapted to grazing rough lands than others. Unfortunately, livestock breeding programs often select animals which do well feeding in a dry lot but not so well on open range. Docile animals which are easy to handle are also selected.

These domestic traits produce poor forages that will not travel far from water holes or graze rugged terrain, this trend can be reversed by selecting animals which show preference for rugged areas while still reproducing acceptable calves.

Many European cattle breeds came from areas where annual rainfall is over 100 centimetres. Their large body size and superior milking ability was suited to an abundance of easily accessible forage. However, rangeland conditions and rainfall (15 to 36 centimetres) in Saskatchewan do not supply such readily abundant forage.

Forage Selection

Grazing animals are selective in what they eat. Diet selection is modified by the presence of secondary compounds (phenolics, volatile oils), plant morphology. (such as thorns and thick cuticle, dried stemy material) and past grazing experience.

Palatability

Livestock select foods which have the most pleasing texture. They also choose familiar foods. Green material is preferred over dry material, and leaves over stems. Palatability is affected by fibre content, bitterness or sweetness, water content and plant abundance.

Preference

Forage selection is more a function of past experience than livestock breed. Grazing is an acquired ability which occurs at an early age. This means that dietary training is possible, as proven with induced grazing of leafy spurge and tall larkspur by sheep in Montana.

Species Differences

There are distinct differences in forage selection among the various herbivore species. Cattle, horses and elk prefer grass, sheep and antelope find forbs more palatable, whereas goats and deer prefer shrubs.

Diet compositions change seasonally as different grasses, forbs, or shrubs become available. An example of food sources used by wildlife can be seen in Appendix III.

Improving Quality

Range management techniques can be used to reduce selective grazing behaviour and provide superior quality forage.

For example, a monoculture such as crested wheatgrass is easy to manage. It is uniform and selectivity is reduced. Applying fertilizer increases the leaf/stem ratio and water content, making crested wheatgrass more palatable and preferable.

Grazing Duration

A number of factors affect foraging time and diet selection of grazing animals. Cows which are pregnant or lactating require more food energy than animals which are not. They must therefore spend more time grazing to meet their nutritional needs. Calves must spend more time grazing as their dams's milk supplies cease to meet their requirements.

Cattle on poor pasture must graze for long periods to meet their nutritional needs.

Preferred food volume and location also affect time spent grazing.

Cattle use their tongues to gather forage before shearing the plants and, as the grass gets shorter, they have to work harder to gather a mouthful, however horses can bite closer to ground level.

Cattle experience a peak grazing efficiency when forage is about 15 centimetres high, eating 70 kg of fresh grass per day. If forage is only five centimetres high, daily intake can be cut to 14 kg. A cow takes between 30 and 90 bites per minute, and by moving her head from side to side in an arc, can bite continuously for up to 30 minutes.

An animal on poor range with short and widely spaced forage plants must take more bites, travel farther and graze longer to meet its daily requirements. In doing so, it uses more energy to acquire food.

Cattle rarely graze for more than nine hours in a 24 hour period. However, in drier regions of the United States cattle will, at times graze for up to 13 hours per day. Cattle ruminate form five to nine hours per day, depending on the fibre content of the forage they consume. Rumination evolved as a predator evasion strategy, creating a sense of well-being in cattle. Supplying hay or straw when pastures are lush and green will increase rumination time and pacify livestock.

Goats prefer shrubs over grass and forbs

The speed at which an animal eats also affects grazing time.

Fast eaters spend more time relaxing in shelter from the elements and predators. Animals which have larger mouths select larger bites of food and therefore eat faster. By comparison, species with smaller mouths such as sheep, antelope and deer, are more selective in what they eat.

Grazing Periods

Livestock exhibit distinct periods of grazing, ruminating, resting, standing and watering. If one becomes familiar with these patterns, livestock moves can often be planned to minimize disturbance of their daily activities.

Livestock also adjust their grazing periods according to day length and weather conditions. Most grazing occurs around dawn and dusk.

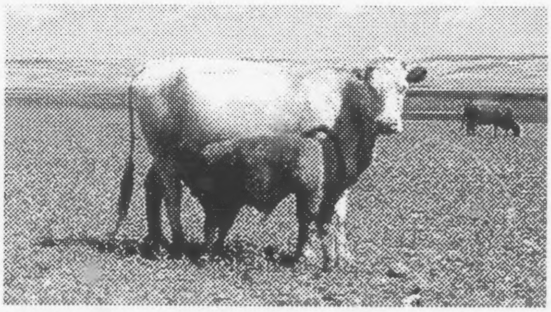
Cattle on productive pasture experience peak grazing efficiency.

Spells of extreme cold or heat may cause animals to alter their products of activity. They may seek shelter or shade to maintain their body temperatures with the least possible stress.

Cattle may graze through the night during full moon periods. At higher, cooler latitudes grazing may continue all day as daylight hours shorten. On the other hand, livestock in warmer climates may feed all night to avoid midday heat.

Changes from normal grazing behaviour alert the producer that something is wrong.

Livestock which crop grass very closely and graze actively during midday probably lack adequate forage in terms of quantity or quality, or both.



Lactating cows have high energy requirements.

Livestock often change their behaviour when placed in large herds or onto new range. They disperse and move through a field rapidly as they compete with other animals in the herd. This can lead to better overall utilization of forage, but also to excessive trampling and forage loss during dry conditions.

If livestock are disturbed by dogs, predators or unfamiliar people, normal activity patterns may be disrupted.

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Managing Saskatchewan Rangeland

Introduction | Water Requirements for Livestock on Pasture | Water Quality | Pasture Watering Alternatives | Cattle Watering Points | Lister Pumps | Solar & Wind Powered Systems | Solar Pumps | Wind Powered Pumps | Conclusion | References

Revised Edition

Introduction

In range management, water quality and quantity for livestock is often taken for granted. In most cases livestock are given direct access to sloughs, dugouts and streams. As a result water sites can be degraded by physical damage to banks and adjacent vegetation. Deposition of manure and urine into the water supply causes both palatability and quality problems for livestock. This can also impact wildlife that depend on wetland vegetation for food, nesting and cover. Technology exists to improve both water quality and availability on pasture while at the same time improving livestock and wildlife production.

Water Requirements for Livestock on Pasture

The water requirements of livestock on pasture are met primarily through voluntary consumption. For livestock, daily water consumption will depend on a number of physiological and environmental factors. Some of these are:

- Size and type of animal
- Physiological state (ie. pregnant, lactating, growing) For every kilogram of milk produces 0.87 kg of water is required. During the last four months of pregnancy water use increases 30-50% above maintenance.
- Activity level (moro active animals require more water).
- Type of diet and amount consumed. (Dry diets induce more water consumption than moist diets such as silage or lush pasture.
- Climatic conditions (Air temperatures above 27° C will double water intake).
- Water quality (palatability and salt will affect consumption).
- Trough space (Total water trough space should allow at least 10% of the herd to drink at one time).

The range of daily water requirements for common livestock species are given in Table 1.

Table 1. The Ranges of Daily Water Requirements for Livestock

Species	Litres/HD/Day	Gallons/HD/Day
Beef Cattle	22-75	5-17
Dairy Cattle	38-100	8-24
Horses	30-45	7-10
Sheep & Goats	5-18	1-4

Source: Anderson, 1982

Water Quality

Water quality has been shown to have effects on livestock gains on pasture. Once total dissolved solids in the water exceed 5,000 mg, total daily feed intake will be reduced while cattle adapt to the elevated levels. This can have a significant economic impact on the profitability of the livestock enterprise.

In a recent 37 day summer trial in Alberta, cows drinking directly from a dugout lost weight and their calves gained, while cows and calves drinking fresh water from the trough gained the most.

In another study using the same water sources. Over a 71 day period 18 month old steers gained 33% more when drinking fresh water verses water from a dugout.

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Pasture Watering Alternatives

Traditionally dugouts have been the major water source for livestock on pasture.

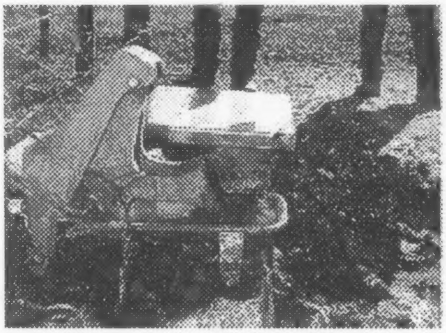
Whether the water site is a dugout, stream, slough or spring the best method for improving water quality for livestock is eliminating direct access to the water source. Developing a watering point with a firm base helps eliminate physical destruction of the site.

Cattle Watering Points

When given the option, cattle tend to water at sites with a solid base that provide good footing. Access ramps with a minimum 6:1 slope topped with compacted pit run gravel built out into the water body will accomplish this. It is important to excavate the ramp back from the water body far enough to reach firm ground. Slope will be dependent on the distance required (ie. the greater the distance, the flatter the slope). If there is not a suitable till or clay base (ie. instable organic soils) then plastic webbing material can be used to hold the gravel in place and prevent it from sloughing into the water body.

Lister Pumps

Lister pumps are designed to allow cattle to pump water for themselves. The animal uses its nose to push a lever that pumps water into a small water bowl. Lister pumps are self priming and deliver 1 quart of water for each stroke of the leaver. Therefore in some situations an adult animal may need to make 50 pumps per day to meet its water requirements. For this reason it is important that one pump be available for every 25 adult animals. A metal splash pan can be positioned under the lister pump to catch spillage from the reservoir and to provide additional water for calves. The pumps should be anchored securely to prevent movement.



Solar & Wind Powered Systems

Solar or wind powered pumps can be used instead of electric or gasoline powered pumps to move water from a water site to the animals. When considering use of these pumping systems it is important to select a system that will meet the demands of your herd. Pumping to a storage reservoir with a gravity feed to a trough equipped with a shut off valve is recommended. This will allow some reserve capacity in case of equipment failure or during peak demand periods.

Solar Pumps

A lister Pump

Solar Pumps

Solar pumps are available in a variety of capacities. They use an array of solar panels to convert sunlight into electrical energy. These solar panels can be used to power the pump directly and can also be used to charge a number of batteries. The batteries will store energy to pump water during periods of overcast skies, or if there is a problem with the solar panels. These systems are quite reliable but are expensive relative to other watering systems.

Wind Powered Pumps

Wind powered pumps have long been used to pump water from wells and dugouts. More recently, windmills that use compressed air to pump water have been used to supply water to smaller herds. Floating diaphram pumps located in dugouts and powered by small windmills located on high ground can pump an average of 120 gallons per hour with a 10 mph windspeed. These pumps lose efficiency as the lift (pumping elevation) increases. Maximum lift should not exceed 25 feet. Windmills should be placed in unsheltered locations away from trees or buildings. On top of dugout spoil piles is often preferred site. It is important to have extra storage tanks and/or trough capacity with wind systems to provide water during prolonged calm periods or equipment failure. A shut-off valve/float system can be installed on the trough and a return line should be installed from the storage tank to the dugout. This is used when the tanks are full otherwise the pumps run continually even through the storage tank is full.

Conclusion

The availability of good quality and reliable water sources is often the key factor in developing an effective grazing program. It is important to protect water sites as much as possible from physical impacts of direct livestock access. Fencing off the water body and pumping to a trough will increase the lifespan of the water sites as well as improving livestock production on pasture and enhance wildlife potential of the site.

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Managing Saskatchewan Rangeland

Definition and Purposes | Complementary | Intensive Grazing Systems | References and Suggested Reading

Revised Edition

Definition and Purposes

Grazing systems manipulate livestock in a planned manner, optimizing livestock and forage production through correct stocking rates and forage use levels.

These systems can be applied to grazing by any kind or class of animal in any rangeland or pasture situation. A well-designed grazing system allows the range to improve while it is being used. Grazing systems control timing, intensity and frequency of grazing of individual plants and improve livestock distribution. Individual animal gains are maximized when they are allowed to graze selectively at low stocking rates and densities. However as stock density and stocking rate increase, individual performance declines, but beef production per acre increases. Overall production declines as a pasture becomes overstocked and overgrazed. Selection of an appropriate grazing system is dependent on vegetation type, physiology of the plants being grazed, type of livestock and the goals of the manager.

Grazing systems should allow for ease of livestock movement.

Over the long term a successful grazing system does the following:

1. Balances livestock numbers with forage supply.
2. Distributes livestock more uniformly over the range, and reduces selective grazing.
3. Alternates periods of grazing with periods of adequate rest. These rest periods must occur during active growth periods to be effective.
4. Maintains a healthy plant community with a desirable distribution of species and plant age classes. Avoids damage to grazed plants when they are most susceptible.
5. Maintains healthy watersheds and soil.
6. Meets physiological needs of grazing animals.
7. Optimizes livestock gain per acre.
8. Uses methods which are environmentally sound, practical to implement, simple to operate and flexible in case of unforseen circumstances.
9. Takes other equally desirable range uses into account.
10. Addresses needs of the entire ecosystem, including plants, wildlife, domestic livestock and soil.

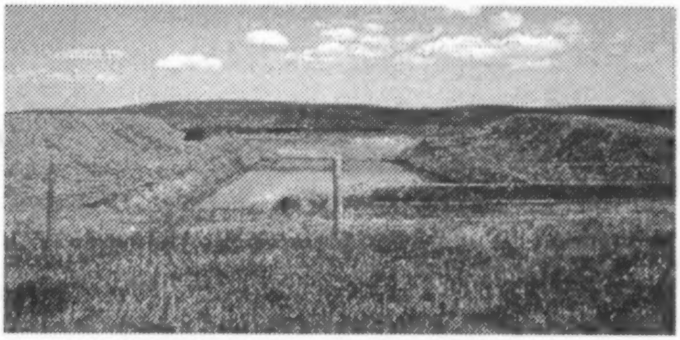
Erecting fences, developing water sites, placing salt and other improvements do not constitute a grazing system. These are tools range managers use to achieve goals. Active management by the manger determines the degree of success.

Misconceptions

There are two common misconceptions about grazing systems.

A well designed grazing system allows the range to improve while it is being used.

1. A universal best grazing system exists. The fact is each operation must develop its own grazing management system tailored to its resources and goals. Managers should feel free to combine traits from more than one grazing system to develop a system that suits their needs and goals.
2. Specialized systems permit a manager to ignore other range management principles. The fact is successful grazing systems rely on range management principles such as proper stocking, animal distribution and proper use to be successful.



Planned water development helps distribute animals uniformly

Many grazing systems have been developed, each having distinct characteristics, advantages and disadvantages. Some grazing systems are not universally applicable and are only successful in certain environments. For example, intensive grazing systems that rely on rapid plant recovery after grazing to obtain multiple grazing during the grazing season may not be suited to areas with short growing seasons and dry climates. Grazing systems that make use of different areas of a pasture at different times of the year may complement or compete with various wildlife species. For example, sharp-tailed grouse and dabbling ducks nest in taller grasses that are carried over from the previous fall. Deer prefer the cover of the current year's dense undergrowth in aspen bluffs or wetland margins for birth and resting of fawns during June.

Brief descriptions of the more common grazing management system follow:

For a quick comparison of grazing systems, required management considerations and potential. (see Appendix IV)

Continuous (season long)
Livestock are turned onto a grazing allotment at the beginning of the grazing season and remain there until the season ends. This system is popular because it is easy to administer and requires fewer improvements and less monitoring than other systems. Stocking rates should be based on a Preferred Use Factor of 50 percent. Continuous systems do little to control livestock distribution or eliminate localized overgrazing. Many well-documented cases of range deterioration can be attributed to continuous grazing.

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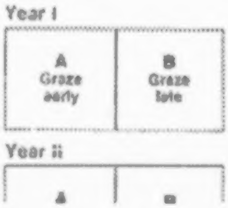
Deferred Grazing
A simple deferred system delays grazing on specified pastures until the key forage species passes through a critical phenological stage, such as seed set. This reduces the length of the grazing season for deferred pastures and may lead to reduced palatability of forage plants. On the positive side, it provides protection for decreaser species and leads to higher protein levels in the remaining winter forage. Stocking rates are usually based on a predetermined Preferred Use Factor.

Two-Paddock Switchback
The range is divided into two paddock by construction of a single crossfence. This allows the producer to concentrate use on one paddock, while resting the other. Livestock may be grazed on the unit for a predetermined length of time or according to growing conditions.



For example, livestock may graze paddock A for the first half of the grazing season, then A is rested until the following year. Pasture B would be grazed during the latter part of the grazing season during year one, as well as the early part of the season during year two. (see diagram 20)

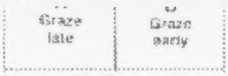


Diagram 20: Two-paddock switchback grazing system.

Deferred-Rotation Grazing (DRG)

This system defers grazing on several pasture units in a planned rotation.

In year one a paddock is grazed early until a predetermined PUF is reached. During year two grazing is deferred until seed ripening to allow maximum carbohydrate storage and trampling of seed into the ground. In year three grazing is deferred to allow new seedling establishment. (see diagram 21)

A minimum of three paddocks are required, making additional fencing and water development necessary. Producers must also spend more time monitoring and moving livestock.

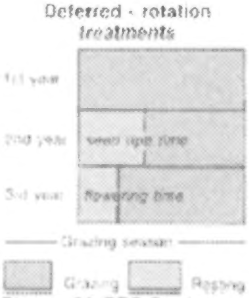


Diagram 21: DRG Grazing system

Reducing selective grazing and overgrazing is achieved by concentrating more livestock on a smaller area and encouraging better overall utilization. Range condition often improves over time with this system, but livestock may gain less than with other systems but gain/acre is higher.

Rest Rotation (RRG)

First developed for Idaho Fescue range, rest-rotation grazing has since been adapted for use elsewhere. It is similar to deferred-rotation grazing but it has the addition of a yearlong rest period once during a three year grazing cycle. This yearly rest period ensures establishment of new grass seedlings and allows for buildup of carbohydrate reserves (see diagram 22). A minimum of four paddocks is required for RRG, thus RRG requires more development that DRG. RRG has the same advantages and disadvantages as DRG. In cases of severe overgrazing, one year of rest may not be sufficient to allow plant recovery.

Some experts regard the yearly rest cycle as a waste of forage. Others speculate whether reproduction by seed is important on perennial range, since most of these plants reproduce by rhizomes.

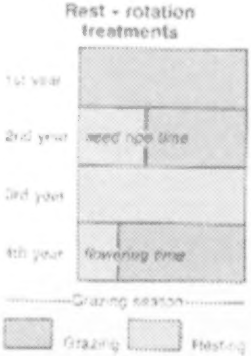


Diagram 22. RRG grazing systems

Complementary

Complementary grazing systems, which manage seeded pastures and native range to enhance the growth characteristics of both, have been successful in Canada. For example, crested wheatgrass provides early, highly nutritious forage at a time when native range is most vulnerable to grazing. Crested wheatgrass can be grazed from late April to about mid-June. Livestock are then turned onto native range until mid-September. Russian wildrye can be grazed from mid-September until freeze-up and, and altai wildrye is grazed through early winter.

In some areas of Saskatchewan, meadow bromegrass is preferred over crested wheatgrass or Russian wildgrass.

The time-controlled intensive grazing system involves careful monitoring

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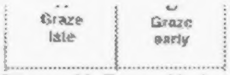

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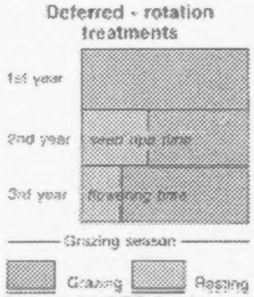

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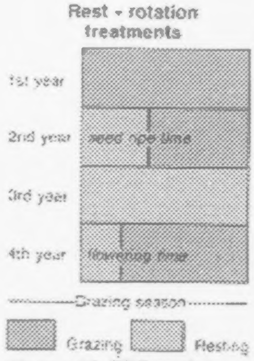

Diagram 22. RRG grazing systems

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In some areas of Saskatchewan, meadow bromegrass is preferred over crested wheatgrass or Russian wildgrass.

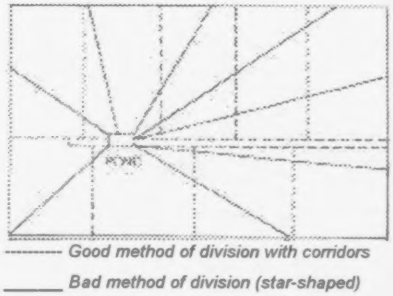
The time-controlled intensive grazing system involves careful monitoring

Meadow bromegrass is easy to establish and competitive, and it provides excellent early spring and fall grazing. It is more versatile than crested wheatgrass because the same pasture may be grazed during both spring and fall.

Intensive Grazing Systems

Intensive Grazing' refers to systems which focus on high management inputs and increased stock control. Intensive grazing generally involves the use of eight or more paddocks of tame grasses (diagram 23). The basic premise of intensive grazing is that livestock at relatively high stock density, but not necessarily stocking rate, are rotated through paddocks based on plant growth and recovery time. The goal is to distribute livestock use evenly over the pasture, and reduce regrazing of individual plants.

Forage production follows a sigmoid curve.



---------- Good method of division with corridors
______ Bad method of division (star-shaped)

Diagram 23: Intensive grazing paddock divisions

Growth is slow in initial stages, rapid during the central period and slow again as leaves die. Timely rainfall speeds growth or regrowth, altering required recovery time. Grazing intervals and rest periods must be altered according to the growth rate.

Since intensive grazing allows plants to remain in the vegetative stage for a longer period of time, they can increase production of leaf area. Once a grass plant enters the reproductive stage, new growth becomes possible only through new basal buds and tillers. Livestock return to paddocks only after plants have regrown adequately. Determining how much forage to remove from a paddock is important, as residual plant material is important for regrowth.

Fertilizing tame pastures can pay off. Proper fertilizers increases leaf to stem ratio of grasses, making plants more palatable. Fertilizer can also increase protein content and water use efficiency. Split application (spring and fall) of nitrogen are recommended, since spring applications are often used up within the first three weeks of spring growth.

Intensive grazing systems have had various names, such as Savory grazing, cell grazing, etc. Often these systems are grouped under three main types; High-Intensity Low-Frequency Grazing (HILF), Short-Duration Grazing and Time-Controlled Grazing. These grazing systems, by definition, have varying paddock numbers, stock densities and rest periods. It is somewhat difficult to separate these grazing systems because they differ only by degrees - there is a continuos gradation from one type to another. It is important to remember that one of the cornerstones of a successful grazing systems is flexibility. Any intensive grazing system should have the capacity for adjustments to grazing periods, stocking rates and densities, to match the prevailing growing conditions. Intensive grazing systems require greater management skill than other grazing systems. Strong commitment from the producer is required for successful implementation of an intensive grazing system.

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Managing Saskatchewan Rangeland

Applications | Using Fencing Effectively | Conventional Wire Fences | Suspension Fences | Electric Fences | References and Suggested Readings

Revised Edition

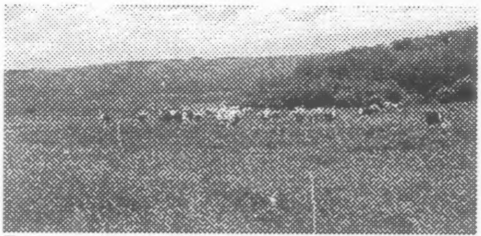
Applications

Fencing is an important range management tool, facilitating the practical regulation of grazing use, rest, stocking rates and animal husbandry. Fences control livestock movement and distribution.

Boundary fences prevent livestock from trespassing on neighboring properties. Drift fences keep livestock from moving off or onto a range, or confine herds to specific elevations. Crossfences are used to subdivide rangeland or pastures into smaller management units, or provide enclosure or enclosure for special uses.

The ideal fence combines low capital cost ease of construction and a long lifespan. It also must be livestock proof. Although fences simplify livestock containment, they can also lead to less effective management of grazing resources. This is because fences, along with water development, can allow the establishment of permanent confines.

Unless proper range management principles are applied a deterioration of grazing resources, both (native and tame) consequently, can result in livestock and forage production far below potential.


Fencing plays a vital role in the range planning process

Using Fences Effectively

A properly located fence is a powerful tool when used in a well-planned grazing system.

Always create fields that are as uniform in vegetation type and range site as possible. Livestock will graze selectively if areas of differing slope, soil and forage type are fenced together. This causes over utilization and under utilization in the same field.

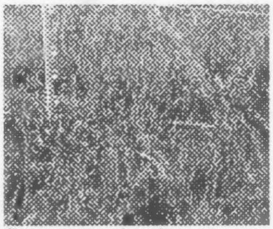
Some areas best be fenced out of the grazing system altogether. For example, weigh the potential for erosion on fragile soils against any economic gains or the use of areas which make livestock handling difficult.

Primary fencelines should follow land contours and boundaries of range sites to separate unique management units. Fence hillsides separately from valley bottoms, and bush apart from grasslands. Fence native grasslands separately from tame pastures, and different tame species apart from each other. Paddocks need not be square and fences need not be permanent. Temporary fencing can be used to subdivide fields on a short-term basis. Strip grazing may accomplish certain goals. Animals can be temporarily confined to achieve brush control. Night confining of livestock is also possible with temporary barriers. Part of a pasture may be reserved for hay production using temporary fencing.

There is no universally ideal fencing design.

Available resources and management goals determine field size and shape. Different sized fields accommodate a variation in grazing period. A particular consideration is the use of machinery.

Fencelines do not need to be straight. Although a straight fence is shorter, it is more efficient in the long-term to follow the contours of vegetation types and landforms.



Temporary fencing

Cattle tend to graze longer in fields that have no shade. However, exposure to long periods of hot weather without shade can adversely affect performance.

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Water Sites

Water is often a limiting factor in planning a grazing system and deciding on fence placement. Poor location of water is usually the major obstacle to overcome.

A centrally located water supply is not necessary for a grazing system to work. Separate water sites are not required for each field. Fences can be used to create alleyways which lead to reliable water supplies. Keep alley ways between a quarter and a half-mile long. Cattle should not have to travel more than a mile on gentle or flat terrain to access water. Shorten this distance in rougher terrain.

Letting cattle drink directly from dugouts, springs and sloughs is a questionable practice. Design fences to exclude livestock from water sites and pump drinking water into troughs. Keep areas around the troughs as small as possible to prevent animal loitering. Ideally, livestock should come to the troughs to drink and return to graze.

Pump livestock drinking water into troughs. Solar pumps are efficient and economical.

Existing Fences

Although many existing fences can be utilized in a grazing plan, it should not be developed around these fences. They can be moved. Always consider best use of the land resources first, and do not let existing fencing limit your thinking in the planning stages.

In Saskatchewan, for example, cross-fences are often constructed on section or quarter section lines. This is convenient but seldom leads to the best use of the grazing resource. The repair of existing fences is another consideration. If major repairs or replacement are necessary, evaluate the current location and construction. A change in placement and technology may lead to improved management.

Conventional Wire Fences

Built for durability, the lifespan of a well-constructed barbed wire fence is 25 to 30 years. Choice of materials and design are important considerations for fenceline longevity.

Posts

Wood posts are used extensively due to availability, ease of handling and low cost.

Steel posts are easier to work with but are more costly than wooden posts. Concrete posts can be formed on the ranch or farm, but must be adequately reinforced with steel. They are heavy and difficult to handle.

To minimize maintenance costs, treat wood posts. Untreated wood which contracts the ground decays in three to 12 years. Pressure-treated wooden posts are usually better than ones treated with a non-pressure process, because the preservative is forced into the wood to a grater depth. Pressure treating can add up to 25 percent to the fence cost but it extends post life by 20 years.

Some preservative treatments can be carried out on your operation. Posts must be well-seasoned for these methods to work. Seasoning normally takes two to four summer months, or a six to eight-month winter period. To determine the degree of seasoning, weigh a few posts weekly. When a post loses less than 0.45 kg (1 lb) per week during good seasoning weather, it is ready to be treated.

Pentachlorophenol, creosote, naphthenates or bluestone can be used. Paint may not stick to posts treated with pentachlorophenol. Creosote is effective but toxic and bothersome to handle.

Bluestone is extremely corrosive to steel. Treatment vats should be wooden, concrete or lined with polyethylene.

Copper sulfate is poisonous to animals. Do not leave tanks unattended and dispose of unused chemicals in safe containers.

Wire

Barbed wire is available in two types - double strand and single strand. Single strand is lighter and stronger, has more barbs per metre and is less costly. Double strand must be stretched, while single strand needs only to be pulled taut.

Barbed wire remains the most common type of range fence

Staples

The recommended staple is galvanized, 1 3/4" x 9 gage with slash-cut points.

Wire Stays

Stays are used to keep wires properly spaced when posts are located at a distance greater than 5 to 7 m (16 to 22 ft).

Two types are available. One-piece stays consist of a wire formed into a double spiral 1 m (40 in) long. It is installed by twisting the top wire down over the bottom wire.

Two-piece stays have a single spiral and a straight wire 1 m (40 in) long. They are installed by placing the spiral wire on one side of the barbed wire and inserting the straight wire through the spiral wire, locking the barbed wire into place.

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The following table provides various sizes of pressure-treated posts.

Post Use	Length		Top Diameter		Approximate Burial Depth	
	(ft)	(m)	(in)	(cm)	(ft)	(m)
Corner, end, and draw posts	8	2.4	5-6	13-15	4	1.2
Corner, end, and draw braces	7	2.1	4-5	10-13	3	0.9
Line posts	7	2.1	3-4	8-10	3	0.9
	6	1.8	3-4	8-10	2	0.6
	6	1.8	2-3	5-8	2	0.6

Construction
Brace and corner assemblies are the foundation of a conventional fence. Braces determine structural soundness and longevity. Corners are braces located where fence direction changes. If any brace or post fails, there is a loss of wire tension and fence effectiveness.

The horizontal brace is widely accepted as the standard fence brace. It is structurally wound and appropriate for most fences. (see diagram 25)

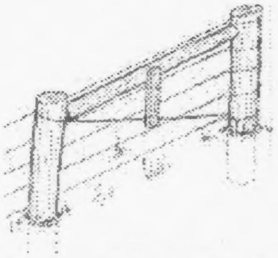

Diagram 25: Horizontal gate or fence end strainer

The diagonal brace is structurally equal to the horizontal one, and is eight percent more resistant to overturn and 25 percent less expensive to buy and install. (see diagram 26). Be sure the end of the diagonal brace which contacts the ground is free to move forward, and that it is not blocked by a stake or post. The diagonal brace should be as long as possible.

Horizontal and diagonal braces can be used together to hold in soft soils. (see diagram 27).

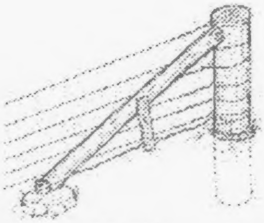

Diagram 26: Diagonal gate or fence end strainer

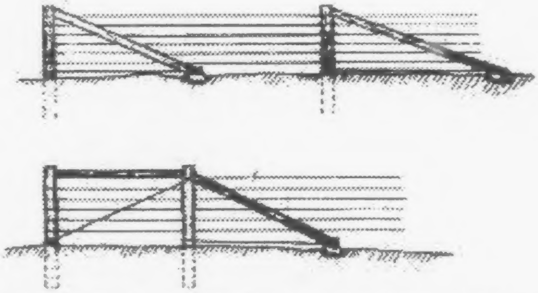

Diagram 27: Use of strainers for holding in soft soil.
Top: Two diagonal strainers. Above: one horizontal and one diagonal strainer.

Corner and end posts should be 13 to 15 cm (5 to 6 in) in diameter and 2.4 m (8 ft) long. Brace posts should have 10 to 13 cm (4 to 5 in) tops and be 2.4 m (8 ft) long. Horizontal braces should have a 9 cm (3.5 in) minimum end diameter and be 2.4 m (8 ft) long. Diagonal braces should be 3 m (10 ft) long.

Line posts are used to suspend the fence wire. Posts can be 6 to 10 cm (2.5 to 4 in) in diameter and 1.8 to 2.1 m (6 to 7 ft) long. They are usually set 0.6 to 0.8 m (2 to 2.5 ft) into the ground at spacing of 5 to 7 m (16 to 22 ft). Shorter posts are used for low fences and deeper-set posts for soft ground.

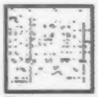

Diagram 28: Wire spacing and line post sizes

Reduce post spacing where terrain is uneven or a particularly strong fence is needed. Increase post spacing on flat terrain or where livestock crowding is not a factor.

The intended use of the fence determines wire spacings. (see diagram 28). To install barbed wire, unroll, stretch and fasten one line at a time starting with the top strand.

To counteract the forces acting on wires, drive staples at an upward angle into posts on rises. Do not use the staple to pull the wire to the post. Hold the wire against the post with your body when stapling.

Unroll the wire on the livestock side of the posts. Tension wires up to 45 kg (100 lb) before stapling line posts.

Never drive staples all the way 'home' on line posts. Leave a space of approximately 3 mm (1/8 in) between the post and wire to allow movement of the wire through the staples. Otherwise, fence impacts are absorbed between the two line posts rather than being distributed evenly between brace assemblies.

If a barb is located within 2.5 cm (1 in) of the staple, clip off the barb.

To prevent pull-out, use the recommended staples and drive them properly. Straddling the wood grain of the post prevents splitting which reduces the staple's holding capacity. (see diagrams 29 and 30)

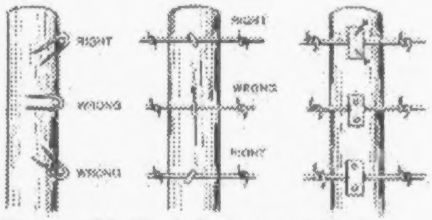

Diagram 29: Staple fastening methods

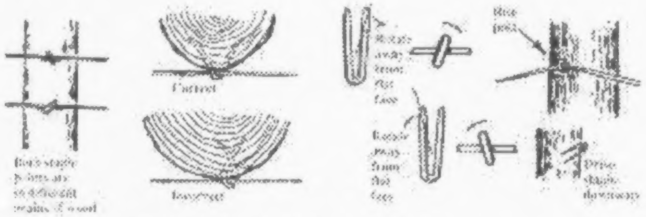

Diagram 30: Correct staple driving method

Slash-cut points act as wedges to force the staple legs to curve away from the flat surfaces of the point as the staples are driven into the wood. To achieve outward curvature, rotate the staple slightly (20 to 30 degrees off vertical) away from the flat surface of the point on the upper leg.

Suspension Fences

Suspension fences were originally developed in Texas as interior or cross-fences. They are not suited to hilly or steeply rolling land.

In contrast to conventional fences which use the barricade principle to stop livestock, the suspension fence functions as a series of panels with resilience and a whip-like action. When pressure is exerted on the top wire, the bottom wire moves in the opposite direction. A cow attempting to reach over the top wire is struck on the leg by the bottom wire. This type of fence tends to sway in the wind, discouraging livestock from attempting to break through. Fewer posts are used compared to conventional construction, lowering costs. The quality and setting of corner and brace posts is particularly important with the suspension fence.

Vertical wire spacings are similar to standard barbed wire fences. The fence loses its effectiveness if the bottom wire or the ends of the wire stays drag on the ground or brush. Wires are fastened to line posts with staples or metal clips. Heavy line posts are spaced from 15 to 50 m (50 to 160 ft) apart depending upon land contour. Wire stays at intervals of 3 to 6 m (10 to 20 ft) are used to maintain wire spacings. Wires should not have more than 7.5 cm (3 in) sag per 30 m (100 ft) span.

Semi-Suspension Fence

This construction is an adaptation of the suspension fence. It is used where terrain is gently rolling.

The semi-suspension fence does not have the live action of a true suspension barricade. It has posts spaced 6 to 14 m (20 to 45 ft) apart.

Electric Fences

High-tensile smooth wire fencing has yet been used in New Zealand and Australia for many years. Now in North America, its popularity is growing rapidly.

Lower costs, less maintenance, ease of construction and proven effectiveness make electric fencing a viable alternative.

These advantages must not be associated with a job that can be hastily completed. Electric fences require more care in construction with attention to details of insulating, grounding and ensuring proper electrical connections.

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Safety

Use caution when stringing the fence to ensure that wires do not touch any power lines. Wires are conductors even before they are energized. When an electric fence runs parallel to a high voltage transmission power line, contact the proper authorities for assistance with grounding procedures.

Never attempt to install any portion of an electric fence or do any repairs when the current is on. Disconnect the feed wires or use cut-out switches to isolate the fence segment under repair.

Installation of a lightning arrestor is a good precaution. Often the lightning protection built in to energizers is not sufficient. Unplug the energizer to protect it during lightning storms, disconnecting the ground and fence terminals.

Affix signs to a fence warning that it is electrified.

Keep farm equipment and any livestock tethered well away from electric fences.

Principles

An electric fence is a physiological barrier, not a physical one. Respect for the fence is the key to its effectiveness. Once trained, animals do not usually come into contact with the fence again.

Electrical flow in a system requires a completed circuit. The electrical current must travel from its source through the complete system and return to the source.

When electricity flows, the circuit is referred to as 'closed'. When the means are there, but no electricity flows, the circuit is 'open'.

Electric fences remain 'open' until an animal closes the circuit by touching a charged wire, allowing the electricity to flow back to its source. An electric current prompts two animal reactions. A small current causes a tingling or burning sensation where applied. The sensory nerves are stimulated in the same way the animal feels hot or cold.

A large electric current interferes with muscle control signals and causes involuntary muscle reaction. The strength of the shock increases with current amount and the same time it is available. After involuntary muscle reaction has occurred, increasing the current does not have any more sensual effect, but starts to produce an electrical burn. Although electric fences deliver high voltages, they are not dangerous because the pulse emitted has a very short duration. A delay of one second between pulses is sufficient to allow for recovery and retreat from the fence. Energy delivered by each pulse is many times less than that likely to kill or injure animals or people.

Components

An electric fence has four essential components - an energizer to supply and regulate the pulse, wire to carry the pulse, posts to support the wire, and insulators to prevent voltage loss where the wire is anchored to a post.

Energizers

Recent improvements in energizers have been the most important advancement in electric fencing technology.

With an energizer the useful life of the fence is increased by reducing the amount of abuse it receives. The fence need not be as sturdy as a conventional fence and maintenance is reduced. This translates into a savings in capital and maintenance costs.

Manufacturers usually indicate the length of wire their energizers electrify. A fence should never exceed a continuous distance of 21 kilometres. Energizers are able to produce a powerful pulse because of low internal resistance, but this effect is lost in long fences.

Today's energizer operates somewhat like an electronic ignition in a car. A capacitor capable of storing electrical energy is slowly charged over a period of 1/3 to 1/2 second. A separate timing circuit discharges or releases the energy from the capacitor through a transformer. The transformer steps up the voltage.

The ability of an electric current to produce an electric shock depends on the size of the current and the surface area it is applied to. A current applied at a single point may result in an involuntary muscle reaction causing the animal to retreat. The same current applied to a large area only causes a tingling sensation.

Fence guard voltage, the voltage available to force current to flow through an animal when it contacts the fence, must be large enough to cause an involuntary muscle reaction to occur.

The thickness of the animal's fur or hair may prevent it from experiencing a shock. Thus it is important to maintain a high guard voltage on the fence, especially during winter when coats are thicker.

Sheep are particularly difficult to control with electric fencing. They are only affected by a shock to their face area, where insulating wool thickness is minimal. If the fence wires are far enough apart, a sheep can get its head through without touching the wires and climb through the fence without getting a shock. Fortunately, sheep tend to graze up to the fence and contact the bottom wire with their face.

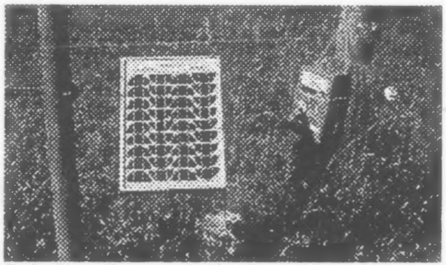
Accepted minimum values for fence guard voltage are 5000 volts for wildlife control, 3000 volts for sheep, 2000 volts for cattle and 700 volts for pigs.

When mainline power is available, 110 or 220 volt plug-in energizers are the most practical. They are often more expensive than battery-operated models, but require no battery maintenance and can electrify-greater distances of wire.

Battery-operated energizers are useful where line power is not available or practical. They are portable and can be used to charge remote lengths of fence. Many have high output (5000 volts) and can energize fences with several kilometers of wire. The most popular battery-powered energizers use a 12-volt rechargeable wet cell battery.

Never operate a battery energizer from a power adaptor or battery charge, even if line power is available. A battery charger is not designed to withstand the high voltage that are linked across it when the ground connection to the ground rod is loose. The transformer in the battery charger often breaks down and may allow hazardous voltages onto the fence.

Solar panels are used to trickle charge a 12-volt battery. The photovoltaic cells in the solar panels act to convert the sun's rays to electric energy. The battery must have enough reserve capacity to operate the fence at night and during prolonged rainy periods.


Solar panels can trickle charge batteries which power energizers

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Wire
Several types and sizes of wire and electric string are available.

High-tensile smooth wire has several advantages over barbed wire: lower cost; does not require prestretching to prevent wire sag; responds elastically along the complete length of wire without barbs snagging in posts or staples; is safer and easier to handle. As well, 12.5 gauge high-tensile smooth wire is approximately 50 percent stronger than two-strand 12.5-gauge barbed wire.

High-tensile 12.5-gauge galvanized wire is a strong wire designed to last many years thirteen gauge wire is easier to handle and somewhat less expensive, but is more suited to temporary fences or cross-fences.

Barbed wire is not recommended, especially if it is old and rusty. It can also pose a safety hazard. Both animals and people can become caught on the barbs and suffer serious injury if the fence is electrified.

Reclaimed telephone wire can be used. It is inexpensive but may require some untangling. However, animals do not always receive a shock from telephone wire because it is galvanized. A zinc coating protects steel wire from oxidizing (rusting). Although zinc itself rusts, the zinc oxide which is formed, creates a tight barrier, preventing air and water penetration. Unfortunately, zinc oxide is also a very good insulator. A thin coating on the wire effectively prevents animals from receiving a shock.

If the animal is well-grounded, a single electrified wire is often adequate for cross-fences. Altering ground wires with live wires is important where precipitation is low or rainfall distribution is poor. The ground wire completes the electrical circuit when soil conditions otherwise form poor ground return.

Perimeter fences should have at least three wires. The top bottom and bottom wires must be electrified and the middle wire grounded.

Posts

Proper corner posts are the most important part of fence construction. They should be of heavier diameter 15 to 20 cm (6 to 8 in) than line posts 5 to 7.5 cm (2 to 3 in). Lighter line posts are used to hold up the wire at proper spacings.

Pressure-treated wood is the most popular type of material for posts and braces. Fiberglass and plastic posts are convenient and easy to use for cross-fences. They are also self-insulating. Good Fiberglass posts have a 10 to 20-year lifespan. Plastic posts may deteriorate in sunlight and become brittle at lower temperatures. Since electric fences do not need to be sturdy physical barriers, post spacing is further apart than with other fences.

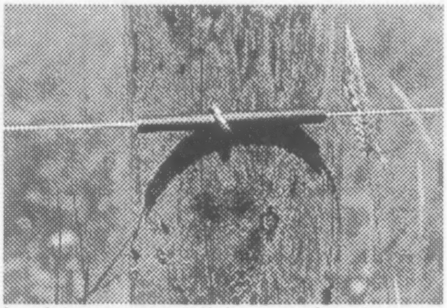
On flat pastures, small wooden posts can be spaced at 45.5 m (150 ft) intervals, with two fiberglass posts in between to maintain wire spacings. Another option is using fiberglass posts at 27 km (90ft) intervals to support one electrified wire in cross-fences. Perimeter fences must have closer post spacings.

Posts need not be at fixed distances. Adjust spacings to fit terrain contours. Fiberglass posts are not suited to rolling terrain. They will pull out of the ground with any amount of tension on the fence.

Insulators

Insulators are used to anchor wire to the post and insulate wire from the post. Plastic and fiberglass posts do not require insulators. It is essential to use insulators on all other types of posts.

Excessive current leakage is the most common cause of electric fence failure. Although some manufacturers advertise energizers that do not require insulators, many other suppliers strongly recommend their use, including models much stronger than those made in North America.



Insulators are essential on wood posts

There are two major types available: porcelain and plastic. Porcelain insulators are easily broken if hit or the wire is over tightened. They generally must be threaded onto the wire, making replacement of a broken insulator inconvenient. They may also be expensive and difficult to find. Good-quality, high-density types of plastic insulators are readily available. Designed to withstand sunlight and temperature extremes, they have lifespan of over 10 years.

Some plastic insulators become brittle under sunlight and lose their insulating qualities.

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Wire Connectors

To make a good connection, use either crimping sleeves, solderless connectors, screw-type line clamps or flexible connectors (see diagram 31). Never twist wires together in the middle or at the end of the fenceline.

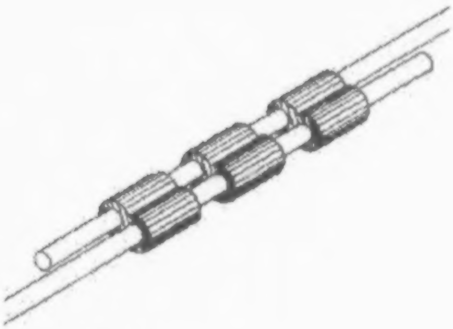


Diagram 31: Crimping Sleeves

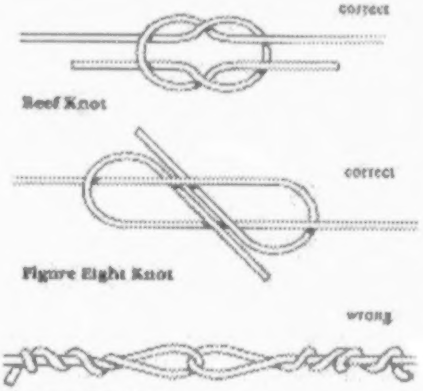


Diagram 32: Knots

The next best splice is a square knot which provides four contact points. Do not use standard loop knots since they provide only one contact point between the two lengths of wire. (see diagram 32)

Grounding

An electric fence will not work without a proper ground. At a minimum, one 3 m (10 ft) long rod is needed for good grounding of a permanent or temporary fence. One 2.7 m (9 ft) long rod is better than three 1.8 m (6 ft) long rods.

Place ground rods where wire cannot be damaged by livestock or machinery. A permanently damp location or low spot is best. This can be located up to 0.8 km from the energizer. Make sure connections are tight and protect them from corrosion. They should be checked each season. When more than one ground rod is necessary, place them a minimum of 1.8 m (6 ft) apart with a continuous length of wire connecting them.

Fence voltage should be checked on every pasture visit

Gates

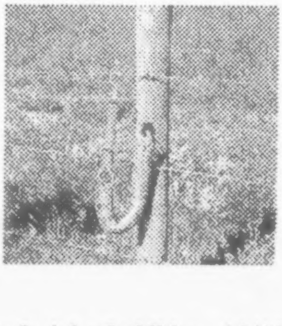
Drive-through or drive over gates are convenient to use. Permanent electric gates with two or more wires and temporary electric gates with a spring-loaded gate handle reduce costs.

Several spring-loaded wire gate handles, connectors, cut-out switches and fence lift mechanisms are available.

Gates should always be electrified from the latch end, so that when the gate is open and lying on the ground the fence will not short out.

However, gates do not need to be electrified. If animals are trained to the fence, they will not usually challenge a gate. Sometimes animals will not pass through an electrified gate even when the power is switched off. For the operator, an unelectrified gate is more convenient to open and close.

Many producers use conventional gates made of barbed wire or galvanized steel and do not electrify them. In these cases, the charge on the fence is carried underground beneath the gateway or overhead. Underground wires need to be protected by running them through plastic pipe buried at least



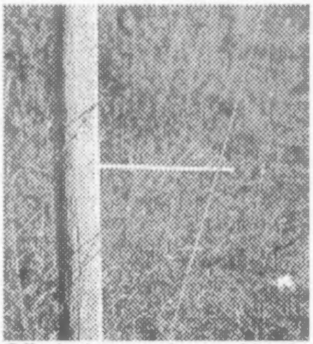
50 cm (20 in) in the ground. The end of the plastic pipe is brought up alongside the gate post, then bent down to keep water out, preventing corrosion.

Spring-type gates are among the various available designs

Electrifying Existing Fences

Existing fences can be made sound again with electric fencing. An offset bracket will hold a high-tensile smooth wire about 22.5 cm (9 in) away from the fence. This prevents shorting out and ensures that animals will touch the electrified wire first.

Position the offset bracket about two-thirds of the height of the animals to be controlled. In drought conditions, ground one or more wires on the existing fence to ensure a circuit.


Offset wires can be used to electrify existing fences

Maintenance

Electric fences require regular attention for proper operation. Inspect and repair all components yearly.

Check fence voltage regularly at several points along the fenceline. A meter or neon tester is a wise investment. Voltage leaks caused by grounding, weed growth and fallen debris are easily detected.

Adjust wire tension due to seasonal temperature changes. Loosen all wires during winter to prevent damage from heavy snow load or extreme temperatures

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Managing Saskatchewan Rangeland

Managing Undesirable Plants | Renovating Pasture | References and Suggested Readings

Revised Edition

Managing Undesirable Plants

A growing problem on Saskatchewan pasture and rangeland is the invasion and spread of undesirable plants. These plants contribute to unhealthy ranges and animals, and can interfere with planned land use.

Undesirable plants include native and introduced grasses, trees, shrubs, and forbs. Some are poisonous. All compete with desirable species for water, nutrients and sunlight, resulting in decreased production of desired forage plants.

Although the term "weed" is often used to refer to undesirable rangeland and pasture species, a weed is any plant growing out of place. This is not always the case with plants referred to as 'range weeds'. Many are part of the natural ecosystem, but their presence or abundance is not compatible with the intended land use.

True range weeds invade rangeland or pasture and are not part of the natural plant complex. Many of these species are noxious and their control is usually legislated.

Learn the names and characteristics of undesirable plants in your area and watch for new growth. It is less costly and easier to manage small infestations than large ones.

Make sure you evaluate the nature and background of the undesirable plant problem before undertaking any treatment measures. The approach and results of these measures are greatly affected by the weedy' plant, past land use and intended land use.

Collect unknown plants and have them identified. Rural Service Centres, Agriculture Canada Centres and Universities can provide assistance with plant identification.

Saskatchewan's most common native woody undesirables. Top: trembling aspen. Above western snowberry.

Native Undesirables

Foxtail barley increases when less attention is paid to grazing management

Since the advent of ranching and other agriculture, livestock foraging habits combined with fire suppression have favoured the development of increasing numbers of woody plants.

Two of the most widely distributed native woody undesirables in Saskatchewan are **western snowberry** and **trembling aspen**. Western snowberry acts as an increaser on many productive range sites. Trembling aspen is the climax species of the aspen parkland, and eventually forms forests in the absence of fire or other disturbances.

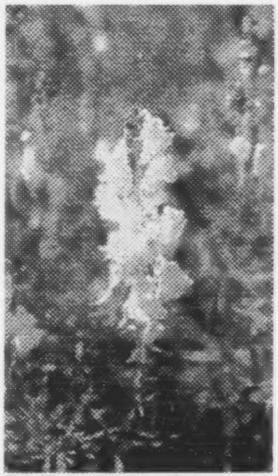
In limited amounts neither plant poses a serious problem because each provides food and cover for wildlife and aids in snow catch. However, treatments may be necessary when pastures and rangeland become dominated by these species.

Pasture Sage, a native half shrub found throughout Saskatchewan grasslands and the parkland, occurs even when rangeland is in excellent condition. It is not a problem until it begins to dominate a range.

Improper grazing management and drought promote the increase of pasture sage. An unpalatable plant for livestock, it always has a competitive growth advantage over grazed species. If management does not address this problem, pasture sage begins to dominate as desirable forage species are grazed out.

Plant growth is reduced by drought conditions, especially on sandy or gravelly soils and on south-facing slopes that have hotter than normal temperatures. Desirable species are soon overutilized if livestock numbers are not adjusted, giving an even greater advantage to ungrazed pasture sage. It responds with a rapid increase in plant numbers. Ground left bare by drying grass plants is soon occupied by pasture sage which is a prolific seed producer.

Foxtail barley is a native grass that increases on saline clay soils during wet years due to a combination of poor drainage, above normal moisture and cool temperatures. Poor grazing management promotes its spread.



Toadflax requires early treatment to minimize its spread.

Grazing of foxtail barley stops once its stiff awns are produced. The forbs and grasses growing nearby are then consumed, giving a competitive advantage to the foxtail barley.

Eventually measures are required to reduce amounts of sage and foxtail barley. However, addressing the original problem of improper grazing management must accompany any control measures.

Introduced Undesirables

Undesirable plants introduced into Saskatchewan from foreign countries are well-adapted to our conditions and have spread throughout the province. **Canada thistle, Russian knapweed, leafy spurge** and **toadflax** are persistent perennials and difficult to manage. Their competitive nature allows these plants to dominate permanent pasture and rangeland, thereby excluding desirable grasses and forbs. Although large tracts of land are frequently occupied, these perennials are usually found in localized patches.

Early treatment may prevent their spread. Keep a record of when and how all measures are taken. Visit the site every year to evaluate the treatment and retreat affected areas when necessary.

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Treatment Measure Definitions

Eradication is the complete kill or removal of undesirable plants, including the elimination of sexual or vegetative reproductive structures. It is difficult and nearly impossible to achieve on a large scale. Small-scale infestations can be controlled provided areas are visited yearly and re-invasions are treated when necessary.

Control is manipulation and management designed to achieve a reduction in the number of undesirable plants. The degree of reduction can vary from slight to nearly complete, and involves keeping undesirable plant numbers at a level that minimizes loss of desirable forage. Control is the most common treatment and is often the only practical management of widespread and well-established native and introduced undesirables.

Prevention refers to avoiding an infestation by keeping an undesirable plant out of an area. Purchasing only clean forage seed and hay, ensuring that tarps are used on trucks, cleaning haying equipment when leaving fields, avoiding driving vehicles across infestations, and watching for 'hitch hikers' on clothing and livestock are prevention methods. Also beware of prevailing winds and waterways which transport seeds. A small percentage of **foxtail barley** seed remains in the inflorescence in winter, it is shed and moves by wind on snow. **Leafy spurge** and **scentless chamomile** seeds travel well in water. When prevention is neglected, control and eradication costs are high.

Control Methods

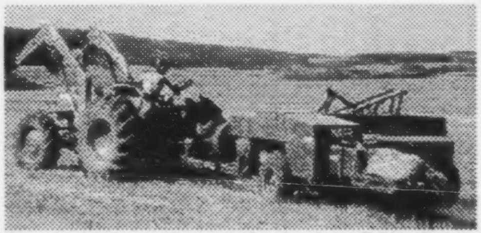
The competitive ability of the undesirable plant must be reduced, with succession proceeding in a desired direction. These goals are achieved by choosing the most appropriate control method for each situation.

There are several methods available for control of undesirable plants. Following are some examples. To determine which method or combination of methods that may fit a specific situation, contact the Extension or Rangeland Agrologist for your area.

Undesirable plant control on permanent pasture and rangeland requires good vegetation management. Success is based on two principles: competition and succession.

Manual Control

Manual control involves pulling, digging and cutting individual plants. These techniques are highly selective but slow, limited to small areas and costly. Manual control is most useful for removing invading plants and cleaning up after other methods. It is employed to remove introduced undesirable plants from around corrals, small permanent pastures and fencelines. Do not give plants an opportunity to set seed.



Cleaning haying equipment before leaving a field helps prevent undesirable plant infestations.

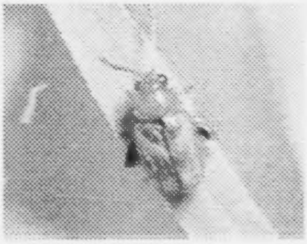
Control By Grazing

Control by grazing may involve a combination of animal species with different dietary preferences or a change in the time a particular field is grazed. For example, sheep may be used to effectively control **leafy spurge** while goats can be utilized to keep brush in check.

Delaying grazing of a native field will allow desirable plants to increase in vigour, thereby gaining a competitive advantage over undesirable plants. Through the use of tame species such as **crested wheatgrass**, and deferred rotational grazing strategies, native fields can be used later in the season. Early use of **crested wheatgrass** is also best for that plant. If **crested wheatgrass** pastures are used late in the season or if stocking rates are too low, large mature plants (wolf plants) will form. Livestock tend not to graze these plants thus reducing the amount of forage utilized and causing problems the next year.

Biological Control

Biological control focuses on natural enemies (predators, parasites and pathogens) of undesirable plants. It targets a single species, avoiding damage to the associated plant community. This is particularly beneficial on rangeland where a mixture of grasses and forbs are desired.



In classical biocontrol, specific host organisms from outside Canada are established on the undesirable plant and attack it on a continuos basis. Stressing the plant with several organism species may be necessary to achieve results. Researchers are determining which organisms are safe and compatible with Saskatchewan conditions to ensure that desirable plants are not attacked. Classical biocontrol is most applicable for introduced undesirables.

The Steppe spurge flea beetle Aphthona nigriscutis is one agent used in the biological control of leafy spurge.

With inundative biocontrol, the organism is applied to the undesirable plant where and when it is a problem in much the same manner as a herbicide. The agent is usually a native fungus disease of natural limited effectiveness due to poor dispersal. It is grown on a nutrient medium and sprayed on the plant in a water suspension. Inundative biocontrol is suited to controlling native undesirable plants because nothing new is added to the environment.

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Mechanical Control
See Renovating Pasture for a discussion of mechanical control techniques and implements.

Chemical Control
Chemical control involves the use of herbicides. Herbicides have several advantages as a control method. Requiring minimum labour, they are effectively used on steep slopes and stony terrain where mechanical equipment cannot operate. The cost of these applications are usually less than mechanical control treatments.

Selective chemical control of broadleaved species is possible, leaving grasses undamaged. After treatment, some living vegetation and litter covers the soil, reducing the risk of water and wind erosion.

However, consider the following disadvantages before using herbicides:

- Some undesirable plants cannot be effectively controlled while desirable forbs and shrubs may be eliminated.
- The cost of control may exceed the value of expected forage increase.
- A poor seedbed results for subsequent seeding
- Careless use can damage off-target crops and contaminate the environment

Before applying and herbicide, check product labels for precautions, grazing and feeding restrictions, general use information and specific application instructions. This will make a difference as to whether the herbicide is used in each situation. Recommendations for specific problem plants and herbicide selection can be found in the Saskatchewan Agriculture and Food publication **'Weed Control In Field and Forage Crops'**.

Renovating Pasture

One aspect of improvement is renovation. In most instances, renovation is needed when management has overlooked the needs of desired plant species. Renovation may include several aspects, from improving management to application of mechanical treatments.

Renovating an area of perennial grass pasture begins with planning. Factors that must be considered include determination of the goals for the field, an evaluation of the costs, desired use, time of use and possible results. These factors must be considered for all the alternative methods of renovation, rejuvenation and reseeding.

Try to estimate whether the returns will pay for the costs incurred. Comparison of all alternatives allows for a decision on the most efficient method. Consider all alternatives before renovating any existing pasture as well as seeding new pasture.

If an existing pasture contains adequate grass cover and some legumes are present, for example, the use of rotational grazing with extended rest periods will return the forage stand to adequate production. Fertilizer use enhances this process in many cases.

The following variables have a major impact on both conversion costs and returns on both renovating existing pasture and new seedings:

- Landform, including amount of stones. Stones may break machinery.
- Soil characteristics, including salinity. Cultivation may bring shallow salt deposits to the surface or leave soils

prone to wind and water erosion.

- Amount and quality of water, both for livestock and vegetation.
- Type and amount of both woody and herbaceous vegetation. Existing vegetation may be difficult to kill and will reestablish from seed and roots stored in the soil. On the other hand, land which has been growing annual crops for many years does not usually cause major difficulties when converting it to forage crops. However, forages have small seeds and may have slow-growing seedlings compared to annual crops.
- Current custom rebreaking costs. Tree and brush removal is expensive.

Costs Versus Returns

Breaking and reseeding may be unnecessary if fertilizer is used on existing on existing pastures. However, if brush regrowth is the major reason for rebreaking, the costs may be a good investment. There are other alternatives that may work in some situations. These include; change in the timing or intensity of grazing, change in the species of animals grazing the area, bark scraping, herbicides and fire. The criteria used to determine which methods used include cost and what the return will be.

Nitrogen is often the limiting factor is forage production, especially if no nitrogen-fixing plants such as alfalfa are in the sward. Fertilizing tame forage with nitrogen almost always increases production even in dry years. However a soil test is recommended to get recommendations on all fertilizer requirements.

However, the question is, will the addition of nitrogen fertilizer pay ? The increased grass and undesirable plant production usually does not equal fertilizer and application costs. Consider, the cost of alternative pasture and expected beef production before applying fertilizer.

Reseeding cost may be warranted if crested wheatgrass or meadow bromegrass is being added to a rotational grazing plan for early spring grazing.

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The following guide is useful in assessing whether to proceed with pasture renovation given various circumstances. Choose those statements that best describe your land and list the number beside each statement you select. Then total these numbers. The larger the total, the more difficult renovation, with a lesser chance of a satisfactory return on your investment.

Landform

1. Land uniformly flat to gently rolling.
2. Land hilly to steeply rolling.
4. Wet, swampy and/or many sloughs, which limit the time of cultivation and area cultivated.
8. Many gullies and coulees, making cultivation difficult, limited in extent or impossible.
16. Stony enough to cause much machinery wear and breakdown.

Soil Type

1. Heavy Loam
2. Loam
4. Heavy clay.
8. Sandy or light loam
16. Sand

Soil Zone

1. Black
2. Grey Wooded
4. Dark brown
8. Light brown

Soil Salinity

1. No salinity
2. Some salinity below the surface
4. Saline patches at the surface
8. Extensive saline areas
16. The whole area is saline.

Stock Water

1. Plenty of water throughout the grazing season.
2. One or two good water sources per quarter
4. One water source per section
8. Very few water sources anywhere

Water Quality
1. Good water
2. Fair water
4. Very poor water

Woody Plants
1. Few woody plants of any size
2. Bluffs or small patches of tall (over 2 m) trees
4. Large areas of shrubs or scrub trees (less than 2 m)
8. Mature trees (5 to 15 m) cover much of the area.

Herbaceous plants
1. Large quantities or areas of poisonous plants
2. Large quantities or areas of unpalatable plants
4. Large quantities or areas of unproductive but edible weeds
8. Small patches of unpalatable or poisonous plants
16. Plant selection is satisfactory but productivity is low
32. No major problems (renovation is then not economical to undertake).

Land Clearing

A crawler tractor (75kw/100 hp or greater unit) equipped with a heavy duty push-blade is usually employed in spring to clear and pile trees into long windrows 30 to 60 m (100 to 200 ft) apart. After a minimum of one growing season, the wood is dry enough to burn. Remaining debris is replied and burnt.

Evaluation is the first step in a pasture renovation

When clearing occurs in summer, trees are uprooted and top soil is piled with the tree roots. The removal of top soil, however, is environmentally unacceptable in areas with a thin soil layer. Large piles of soil and tree parts make excellent sites for undesirable plant invasions such as Canada thistle and absinth.

Bull dozing trees when the soil is frozen in early winter cuts most trees off at ground level, leaving the soil in place. This operation usually requires a v-shaped cutter mounted on the front of a large (100 kW/135 hp or greater) bulldozer. Later the trees are piled in windrows about 60 m (200 ft) apart and burned. Although environmentally more acceptable, winter clearing leaves the roots of sprouting species intact and regrowth may be rapid, unless livestock are able to consume these nutritious sprouts in late summer/fall. Another benefit is that breaking and seeding may not be required if there are an abundance of palatable understorey native species.

Excessive brush regrowth may necessitate rebreaking.

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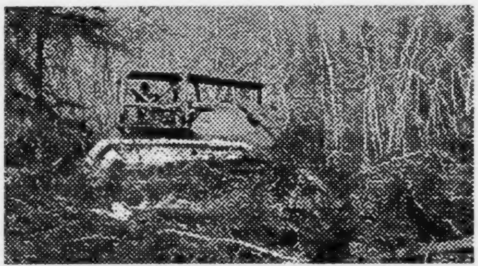
Breaking or Rebreaking

Newly cleared or old depleted land is commonly broken using heavy-duty 11 cm (28 in) or greater serrated tandem offset disk plows. This equipment, pulled with a bulldozer or large four-wheel drive tractor, has two gangs to move soil in opposite directions. This eliminates the twice-over operation required of single-disk plows. Offset disks leave considerable mulch at or near the soil surface, slowing soil erosion. They are not suited for stony land or where large brush is present. Discing does not selectively clear land. Both undesirable and desirable plants are killed.



Bulldozing is a familiar land clearing method in Saskatchewan

Crawler tractor pulling a heavy breaking disk.

Following breaking of an old pasture stand or new land, additional tillage is required to control shallow-rooted species and prepare seedbeds. The more tillage the better, since a well-worked and firm seedbed is necessary for good seed depth control and seedling establishment.

One workdown method uses a heavy tandem serrated farm disk. A heavy log or railway steel pulled behind the tandem disk helps breakup the sod clumps and level the land.

Reseed old depleted pastures after fields have been well-worked and the old sod clumps are dead. If the area is reseeded too soon after breaking, the new stand reverts back to the original plant species within a few years. Even if the sod clumps are dead, the ground contains viable seeds from the previous grass stands. These seeds germinate and compete with the new introduced species. One way to reduce this problem is to seed spring or winter annual cereals such as oats, rye or wheat for one to three years. This helps clear the seedbed of the previous forage stand.

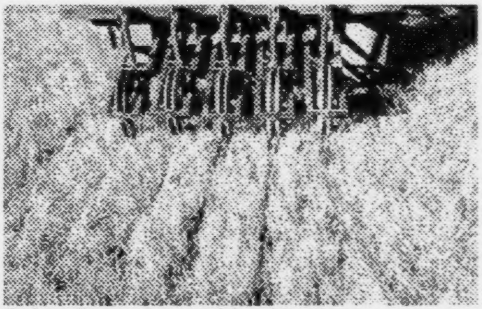
Mowing is most effective on plants up to 30 cm

Another method is to spring-seed fall rye and sweetclover. This stand can be rotationally grazed during the summer and early fall. With a fall rest period the fall rye and, especially the sweetclover, provide excellent grazing the second year. The area is then worked down with heavy-duty disks in the fall prior to freeze-up. Moisture conditions are critical for deep tillage penetration. The following spring the area is seeded to forage as early as possible to take advantage of spring moisture.

Seed Drills

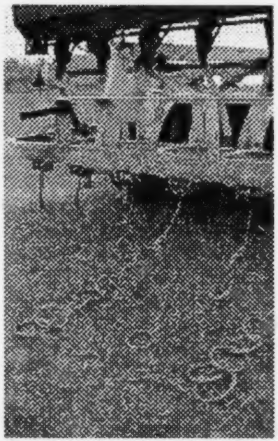
There are very few seed drills designed especially for seeding in rough and stony pastures. The ideal drill is heavy duty, and has independently suspended seeding disks with depth control devices to limit penetration to about 2.5 cm (1 in). Packing wheel attachments, or cover chains dragged behind the drill, are also essential. A well-packed seedbed improves forage establishment.

Spacings of about 30 cm (12 in) provide adequate pasture stands. These spacings also allow small rocks to pass between the seeding disks. Broadcasting is usually not recommended because of uneven seed placement and poor seed cover.



Sod-seeding requires special equipment.

Separate seedboxes for grass seed and legumes are required. Grass seedboxes must have agitators for the grass seeds and smooth-flowing, accurate metering systems. (The Prairie Farm Machinery Institute in Humboldt and Portage la Prairie, as well as the Agriculture Canada Research Stations at Melfort and Swift Current, have evaluated several seed drills. These reports are available upon request).


A rangeland seeder with dragging chains

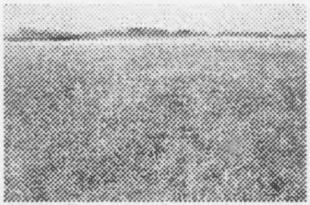
Companion Crops

A companion crop provides grazing, hay or grain in the year of forage establishment, helps shield the land from wind and water erosion, and offers some protection to the forage seedling against extreme weather. Annual cereal stubble also has the added benefit of trapping snow.

On the other hand, companion crops compete with the forage seedlings for water, light and nutrients. They also make undesirable plant control more difficult because suitable herbicides may not be available that can be used on both companion crop and forage.

Another problem is reduced forage yield the year following the seedling of a companion crop. This yield loss may continue for several years is establishment conditions are poor. Annual cereals can be used for pasture, hay or allowed to mature, depending on the grower's requirements and judgement of seasonal needs. Spring wheat is the least competitive, followed by oats and barley.

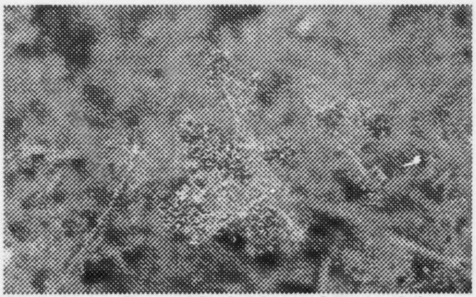
The seeding rate of a cereal companion crop should be adjusted according to its purpose. For providing protection from the elements, a very light seeding rate is satisfactory. Where a crop is desired, half the normal seeding rate is often recommended. This affects companion crop yield little while competing less with the forage seedlings. Canola, preferably the Polish varieties, is often used as a companion crop but is more competitive than cereals. No companion crop seeding rate allows both the crop and forage to achieve maximum production.


Alfalfa, Russian wildrye and companion crop stubble.

Careful grazing of companion crops will not damage the underseeded forage provided the soil is not so wet that the surface cannot bear the weight of animals. A short intensive graze is preferable to a long grazing period. The companion crop should not be grazed to such a degree that the forage seedlings are eaten off.

Forage

Consult Forage Crop Recommendations and Forage Manual for more information on Saskatchewan forage varieties. The are available from Saskatchewan Agriculture and Food offices or write the Publication Distribution Centre, Saskatchewan Agriculture and Food, 3085 Albert St., Regina, Sk. S4S 0B1.


Alfalfa is one of several Saskatchewan forage varieties.

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Renovation Methods

Renovating existing pastures can be accomplished through many methods. Often these are less expensive than rebreaking the reseeding.

Renovation may involve spiking a sod-bound pasture 10 to 12 cm (4 to 5 in) deep. When a field is said to be sod-bound, the cause is generally low available nitrogen. By 'ripping' the field some plants and roots are killed. As these materials decompose, nutrients ae released for uptake by remaining plants. The field may be 'ripped' once or twice. Deep banding fertilizer into a sod-bound field of tame grass accomplishes both a thinning and placement of nutrients into the root zone.

Rotary mowers, which have one or more horizontally rotating blades, can cut plants 10 to 30 cm (4 to 12 in) above the ground. Lightweight mowers are often employed to cut herbaceous weeds. Heavy-duty mowers are effective on tall-growing plant species but ineffective on low-growing and semi-prostrate undesirables. For example, foxtail barley or scentless chamomile can flower and set seed a few weeks after mowing.

To prevent seed set, always carry out multiple mowing treatments starting early in the season. A single-rotary mower treatment is ineffective against root sprouting. Multiple mowings during the year and over several years work provided they are timed to reduce plant food supplies stored in the root system.

Direct Seeding (Sod- Seeding)

Research to date concerning forage seeding without cultivation shows that while the existing vegetation can be killed with a chemical application, the seedbank in the soil is not affected and re-establishment occurs along with the seeded forages.

Alfalfa can be established or its presence increased in pastures in the Grey Wooded Soil Zone, sometimes by seeding directly into the existing sod, but more reliably by seeding into a previously killed strip about 30 cm (12 in) wide. In the Dark Brown Soil Zone, trials have produced a satisfactory stand of alfalfa about half of the time. Good stands are rarely obtained in the light Brown Soil Zone.

In wet years, spraying and seeding in one operation is sucessful, but more uniform results are obtained if the sod is killed in spring and the alfalfa is seeded late the following fall.

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Agriculture and Food
Saskatchewan

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Managing Saskatchewan Rangeland

Grasses | Grasslike Plants | Forbs | Shrubs and Trees | Poisonous

Revised Edition

Important Saskatchewan Range Plants

Grasses

Alkali cord-grass	Spartina garcilis
Awned wheatgrass	Agropyron subsecudum
Big bluestem	Andropogon gerardii
Blue grama	Bouteloua garcilis
Canada bluegrass	Poa compressa
Canada wildrye	Elymus canadensis
Canby bluegrass	Poa canbyi
Cotton grass	Eriophorum spp.
Desert salt grass	Distichlis stricta
Fowl bluegrass	Poa palustris
Fowl manna grass	Glyceria striata
Fox tail (wild) barley	Hordeum jubatum
Fringed brome	Bromus ciliatus
Green Foxtail	Setaria viridis
Green needlegrass	Stipa viridula
Hairy wildrye	Elymus innovatus
Hooker's oatgrass	Helictotrichon hookeri
Indian rice grass	Oryzopsis hymenoides
June grass	Koeleria cristata
Kentucky bluegrass	Poa pratensis
Little bluestem	Schizachyrium scoparium
Marsh reed grass (blue joint)	Calamagrostis canadensis
Mat Muhly	Muhlenbergia richardsonis
Narrow reed grass	Calamagrostis neglecta
Needle-and-thread	Stipa comata
Northern awnless brome	Bromus pumpellianus
Northern reed grass	Calamagrostis inexpansa
Northern wheatgrass	Agropyron dasystachyum
Nuttall's salt-meadow-grass	Puccinella nuttalliana
Parry oatgrass	Danthonia parryi
Pine grass	Calamagrostis rubescens
Plains muhly	Muhlenbergia cuspidata
Plains reed grass	Calamagrostis montanensis
Prairie cord grass	Spartina pectinata
Porcupine grass	Stipa spartea
Purple oatgrass	Schizachne purpurescens
Reed canary grass	Phalaris arundinacea
Rough Fescue	Festuca scabrella
Rough Hair grass	Agrostis scabra
Sand dropseed	Sporobolus cryptandrus
Sand grass	Calamovilfa longifolia
Sandberg's bluegrass	Poa sandbergii
Sheep Fescue	Festuca ovina

Side-Oats grama	Bouteloua curtipendula
Slender wheatgrass	Agropyron trachycaulum
Slough grass	Beckmannia syzigachne
Sweet-grass	Hierochloe odorata
Switch grass	Panicum virgatum
Timber oatgrass (intermediate)	Danthonia intermedia
Tall manna grass	Glyceria grandis
Tufted hair grass	Deschampsia caespitosa
Western porcupine grass	Stipa curtiseta
Western wheatgrass	Agropyron smithii
White-grained rice grass	Oryzopsis asperfolia
Whitetop spangletop	Scolochloa festucacea

Grasslike Plants

Awned sedge	Carex atherodes
Baltic rush	Juncus balticus
Beaked sedge	Carex rostrata
Graceful sedge	Carex praegracilis
Low sedge	Carex eleocharis
Sun-loving sedge	Carex pensylvanica
Thread-leaved sedge	Carex filifolia

Forbs

Absinth	Artemisia absinthium
American vetch	Vicia americana
Baneberry	Acaea rubra
Biennial wormwood	Artemisia biennis
Bunchberry	Cornus canadensis
Cactus	Optuntia spp.
Canada thistle	Cirsium arvense
Canada anemoe	Anemone canadensis
Colorado rubberweed	Hymenoxys richardsonii
Cow parsnip	Heraceleum lanatum
Cream coloured vetchling	Lathyrus ochroleucus
Crocus	Anemone patens
Curled Dock	Rumex crispus
Dandelion	Taraxacum offincinale
Dense club-moss	Selaginella densa
Diffuse knapweed	Centaurea diffusa
Dotted blaze star	Liatris punctata
Everlasting (pussy-toes)	Antennaria spp.
False Solomon's-seal	Smilacina stellata
Field bindweed	Convouvulus arvensis
Fireweed	Epilobium angustifolium
Fleabane	Ergeron spp.
Gaillardia	Gaillardia aristida
Goatsbeard	Tragopogon dubius
Golden bean	Thermopsis rhombifolia
Goldenrod	Solidago spp.
Gumweed	Grindelia squarrosa
Hairy golden aster	Heterotheca villosa
Hareball (bluebell)	Campanula rotundifolia
Hoary cress	Cardaria spp.
Indian breadroot	Psoralea esculenta
Indian paintbrush	Castilleja spp.
Kochia	Kochia scoparia
Leafy spurge	Euphorbia esula
Meadow rue	Thalictrum spp.
Milk-vetches	Astragalus spp.
Milkweed	Asclepias spp.
Moss phlox	Phlox hoodii
Northern bedstraw	Galium boreale
Pale comandra	Comandra pallida
Perennial sow thistle	Sonchus arvensis
Poverty weed	Iva axillaris
Prairie coneflower	Ratibida columnifera
Prairie sage	Artemisia ludoviciana

Purple prairie clover	Petalostemon purpureum
Purple vetching/peavine	Lathyrus venosus
Red samphire	Sailcornia rubra
Russian knapweed	Centaurea repens
Scarlet mallow	Malvastrum coccineum
Scentless chamomile	Matricaria maritima
Silverleaf psoralea	Psoralea argophylla
Skeleton weed	Lygodesmia juncea
Smooth aster	Aster laevis
Spiny ironplant	Haplopappus spinulosus
Sweet broom	Hedysarum spp.
Tansy	Tanacetum vulgare
Three flowered avens	Geum triflorum
Toadflax	Linaria vulgaris
White prairie aster	Aster falcatus
Wild licorice	Glycyrrhiza lepidota
Wild red raspberry	Rubus idaeus
Wild sarsaparilla	Aralia nudicalis
Yarrow	Achillea spp.
Yellow avens	Geum aleppicum

Shrubs and Trees

Alder	Alnus spp.
Balsam poplar	Populus balsamifera
Bearberry	Archtostaphylos uva-ursi
Broomweed (broom snakeweed)	Gutierrezia sarthrae
Canada buffaloberry	Shepherdia canadanesis
Chokecherry	Prunus virginiana
Creeping juniper	Juniperus horizontalis
Dry ground cranberry	Vaccinium vitis-idaea
Gooseberry	Ribes spp.
Greasewood	Sarcobatus vermiculatus
Hawthorn	Crataegus spp.
Nutall's atriplex	Atriplex nuttallii
Pasture (fringed) sage	Artemisia frigida
Pincherry	Prunus pensylvanica
Rabbitbrush	Crysothamnus nauseousus
Red-osier dogwood	Cornus stolonifera
Rose	Rosa spp.
Saskatoon berry	Amelanchier alnifolia
Shrubby cinquefoil	Potentilla fruticosa
Silver sagebrush	Artemisia cana
Skunkbush	Rhus trilobata
Spreading dogbane	Apocynum-androsaemilfolium
Trembling aspen	Populus tremuloides
Twining honey suckle	Lonicera glaucescens
Western snowberry	Symphoricarpos occidentails
Willow	Salix spp.
Winterfat	Ceratoides lanata
Wolf-willow (silverberry)	Eleaegnus commutata

Poisonous

Seaside arrow-grass	Triglochin spp.
Death camas	Zygadenus gramineus
Horsetail	Equisteum spp.
Leafy spurge	Euphorbia esula
Locoweed	Oxytropis spp.
Narrow-leaved milk-vetch	Astragalus pectinatus
Silvery lupine	Astragalus bisulcatus
Two-groved milk-vetch	Cicute spp.
Water hemlock	

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Friday, April 30, 2004

Managing Saskatchewan Rangeland

Revised Edition

Plant Characteristics

Name of Plant	Type of plant				Life span			Origin of Plant		Season of Growth		Grazing Response			Forage Value		
	Grass	Grasslike	Shrub	Forb	Annual	Biennial	Perennial	Native	Introduced	Cool	Warm	Decreaser	Increaser	Invader	Good	Fair	Poor
Alkali cord grass	*						*	*			*	*					*
Arrow-Grass				*			*	*		*			*				*
Awned wheatgrass	*						*	*		*		*			*		
Baltic rush		*					*	*		*			*				*
Blue Grama	*						*	*			*		*		*		
Broomweed			*				*	*		*			*				*
Canada bluegrass	*						*		*	*				*	*		
Canada wildrye	*						*	*		*		*			*		
Canby bluegrass	*						*	*		*		*			*		
Chokecherry			*				*	*		*		*				*	
Dandelion				*			*		*	*				*			*
Death camas				*			*	*		*			*				*
Dense club-moss				*			*	*					*				*
Desert saltgrass	*						*	*			*		*				*
Pussy-toes everlasting				*			*	*		*			*				
Fireweed				*			*	*		*			*			*	
Foxtail barley	*						*	*		*			*				*
Fringed brome grass	*						*	*		*		*				*	
Geranium (sticky)				*			*	*		*		*			*		
Goatsbeard				*		*			*	*				*			*
Greasewood			*				*	*			*		*			*	

Green needlegrass	*						*	*		*		*			*		
Gumweed				*		*		*		*			*				*
Hairy wildrye	*						*	*		*			*			*	
Hooker's oatgrass	*						*	*		*		*				*	
Indian rice grass	*						*	*		*		*			*		
June grass	*						*	*		*			*		*		
Kentucky bluegrass	*						*		*	*				*	*		
Little bluestem	*						*	*			*	*					*
Loco-weed				*			*	*		*			*				*
Marsh reed grass	*						*	*		*		*				*	
Moss phlox				*			*	*		*			*				*
Narrow-leaved milkvetch				*			*	*		*			*				*
Needle-and-thread	*						*		*	*			*		*		
Northern wheatgrass	*						*	*		*		*			*		
Nuttall's atriplex			*				*	*			*	*			*		
Parry oatgrass	*						*	*		*			*		*		
Pasture sage			*				*	*		*			*				*
Plains muhly	*						*	*			*		*			*	
Prairie cord grass	*						*	*			*	*			*		
Prairie sage				*			*	*		*			*			*	
Rose			*				*	*		*			*				*
Rough fescue	*						*	*		*		*			*		
Sandberg's bluegrass	*						*	*		*			*		*		
Sand dropseed	*						*	*			*		*			*	
Sand grass	*						*	*			*	*				*	
Saskatoon berry			*				*	*		*		*				*	
Shrubby cinquefoil			*				*	*		*			*				*
Silver sagebrush			*				*	*		*			*			*	
Slender wheatgrass	*						*	*		*		*			*		
Slough grass	*				*			*		*			*			*	
Thread-leaf sedge		*					*	*		*			*		*		
Timber oatgrass	*						*	*		*			*		*		
Tufted hair grass	*						*	*		*		*			*		
Two-groved milk-vetch				*			*	*		*			*				*
Vetch				*			*	*		*		*			*		
Vetchling				*			*	*		*		*			*		
Western porcupine grass	*						*	*		*		*			*		
Western snowberry			*				*	*		*			*				*

Western wheatgrass	*						*	*		*			*		*		
Willow			*				*	*		*		*				*	
Winterfat			*				*	*		*		*			*		
Yarrow				*			*	*		*			*				*

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Saskatchewan

Managing Saskatchewan Rangeland

Revised Edition

Seasonal Habitat Use and Limiting Factors for Some Wildlife Species

Species	Food			Habitat			Limiting Factors
	grass	forb	shrub	grass	shrub	tree	
Antelope	early spring	Summer	fall winter	summer	fall winter		• require a 10 square miles block of native grassland and unimpeded travel routes.
Mule Deer	spring	summer	fall winter	year round	year round		• require dense shrub understory (for cover against predators) associated with rugged terrain
White-tailed Deer	spring	spring summer	fall winter	spring	summer	summer fall winter	• requires dense shrub understory for cover against predators, severe winter conditions and protection of fawns in spring
Moose		spring	summer fall winter			year round	• large blocks of contiguous forest • adequate winter browse • access to evergreens is necessary for shelter in severe winter conditions
Elk	spring summer	spring summer	fall winter	spring summer	summer	fall winter	• large block of contiguous treed habitat • access to evergreens in severe winter conditions
Sharp-tailed Grouse			year round	year round	year round		• require blocks of at leats 200 acres of native grass • shrub within 1 mile of dancing gronds • moderately to lightly grazed pastures are preferred to ungrazed sites.

Ruffed Grouse		spring summer	fall winter		spring	summer fall winter	- lack of understory vegetation in bluffs due to overgrazing will cause ruffled grouse to leave the area - drumming logs and mature catkin bearing aspen trees for winter food are essential
Sage Grouse		year round	year round		year round	year round	- lack a funtional gizzard, therfore, cannot digest seeds. The diet consists of green leafy material (sage brush leaves) and insects.
Ring-necked Pheasant	year round (prefer farm crop)				year round (50%-70% cultivated)	severe winter	- shortage of dense shrub cover along streams during winter and spring
Ferruginous Hawk	year round			year round		isolated tree in grassland	- requires a minimum 1 mile of native grassland around a nest site for hunting of ground squirrels, mice, etc.
Prairie Falcon	year round			year round			- requires rugged terrain such as steep slopes and cliffs of Frenchman Valley
Waterfowl	geese summer			ducks spring	ducks spring		- dabbling ducks prefer to nest in unhayed or lightly grazed uplands adjacent to wetlands
Piping Plover	spring summer fall			spring summer fall			- nests and feeds on open sandy beaches, sand flats, drained river floodplains where vegetation cover is less than 20% - subject to human distance and fluctuating water levels (irrigation or flooding)

For more information on these species contact, Saskatchewan Environment and Resource Management, Ducks Unlimited Canada, Canadian Wildlife Service, Nature Saskatchewan Wetland Conservation Corporation.

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Table 1. Comparison of Selected Grazing Systems

A. System Requirements

Grazing System	Minimum Number of Fields	Relative Level of Investment	New Water Needs	Labour & Skills
Continuous	1	low	none	low
Deferred	1	moderate	none	low
Light	1	low	none	low
Complementary	2	moderate	moderate-high	low
Deferred Rotation	2	moderate	moderate	moderate
Switchback	2	moderate	moderate	high
Repeated seasonal	3	moderate-high	moderate-high	moderate
Rest rotation	4	high	high	high
H.I.L.F.*	8	very high	very high	very high
SD/TC*	8	very high	very high	very high

B. Management Considerations

Grazing System	Facilitation of Animal Handling	Suitability for Improvement Practices	Potential for Improving Range Condition
Continuous	low	low	low
Deferred	low	low	moderate
Light	low	low	moderate
Complementary	low-moderate	low-moderate	moderate
Deferred Rotation	low-moderate	low-moderate	moderate
Switchback	low	low-moderate	low
Repeated seasonal	moderate	low-moderate	low-moderate
Rest rotation	high	high	very high
H.I.L.F.*	very high	very high	low
SD/TC*	very high	very high	low

C. Potential Gain/Risk

Grazing Strategies	Relative Gain Per Animal	Relative Gain Per Acre	Risk of Plant &Animal Soil Damage
Continuous	high	low-moderate	low
Deferred	moderate	moderate	low
Light	very high	low-moderate	very low
Complementary	moderate-high	very high	low
Deferred Rotation	low-moderate	moderate-high	low
Switchback	nd*	nd	nd
Repeated seasonal	moderate	moderate	low-moderate
Rest rotation	low-moderate	moderate	low
H.I.L.F.*	very low	high	very high
Short duration	low	high	very-high
Time Controlled	low	high	high

* H.I.L.F.: high-intensity low-frequency grazing.
SD: Short-duration grazing.
TC: time-controlled grazing.
ND: limited data

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These definitions are complied from the Society for Range Management publication Glossary of Terms Used in Range Management. 3rd. Ed. 1989. and North American Range Plants. 3rd Ed. 1986.

Acute. A grass blade or ligule which is abruptly sharp pointed.

Animal-Unit-Equivalent. A number expressing the energy requirements of a particular kind or class of animal relative to one A.U. Abbr. AUE

Animal Unit Month (AUM). The amount of dry forage required by one animal unit for one month based on a forage allowance of 26 pounds per day. Not synonymous with animal-month. Abbr. AUM. The term AUM is commonly used in three ways: (a) Stocking rage, as in "X acres per AUM"; (b) forage allocations, as in "X AUMs taken from unit B"; (c) utilization, as in "X AUMs taken from unit B"

Auricle. An ear-like lobe or appendage at the base of the leaf blade of certain grasses.

Awl-shaped. Narrow and sharp pointed.

Bunchgrass. A growth habit of forming a bunch or a clump.

Carrying capacity. A measure of a range type's ability to produce a sustained forage yield, and thus to meet the requirements of the grazing animal. Carrying capacity is based on a safe utilization level based on mean annual forage production and the plant communities's tolerance of grazing pressure. Carrying capacity does not fluctuate yearly in response to forage production and stocking rates, but does fluctuate with weather conditions.

Ciliate. Fringed with hairs on margin.

Climax. (1) the final or stable biotic community in a successional series which is self-perpetuating and in dynamic equilibrium with the physical habitat; (2) the assumed end point in succession. ef. Potential natural community.

Decreaser. Plant species of the original or climax vegetation that will decrease in relative amount with continued overuse.

Degree of Use. The proportion of a current year's forage production that is consumed and /or destroyed by grazing animals.

Ecology. The study of the interrelationships of organisms with their environment.

Ecosystem. Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space.

Ecotone. A transition area of vegetation between two communities, having characteristics of both kinds of neighbouring vegetation as well as characteristics of its own. Varies in width depending on site and climatic factors.

Ecotype. A locally adapted population of a species which has a distinctive limit of tolerance to environmental factors.

Edaphic. Refers to soil

Grazing cell. An area of land planned for grazing management purposes

Grazing System. The manipulation of livestock in a planned manner in order to accomplish a desired goal.

Herbivore. An animal which feeds on plants

Increaser. Plant species of the original vegetation that increase in relative amount, at least for a time, under overuse.

Invader. Plant species that were absent in undisturbed portions of the original vegetation of a specific range site and will encroach following disturbance or continued overuse.

Ligule. The appendage, membrane or ring of hairs at the junction of the leaf sheath and blade.

Membranous. Thin, opaque, not green; like a membrane.

Obtuse. Blunt or rounded at the end.

Paddock. A division of land within a grazing cell.

Palatability. The relish with which a particular species or plant is consumed by an animal.

Pasture. A grazing unit seeded to tame forages.

Phenology. The study of periodic biological phenomenon such as flowering and seed-set, especially relating to climate.

Preference. A selective grazing response exhibited by animals when confronted with choices.

Proper Use Factors (PUFS). The percentage of utilization (for a forage species or range type) deemed as acceptable to improve or maintain range condition.

Pubescent. Covered with short soft hairs.

Quadrat. In strict terms, a square sample unit or plot. In practical terms, quadrats vary in size and shape according to the plant community being sampled.

Range. Any land supporting vegetation suitable for grazing including rangeland, grazable woodland and shrubland. Range is not a use. (adj) Modifies resources, products, activities, practices and phenomena pertaining to rangeland. ef. rangeland, forested range, grazable woodland, shrubland.

Rangeland. Land on which the native vegetation (climax or natural potential is predominantly grasses, grass-like plants, forbs or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing. Rangelands include natural grasslands, savannas, shrublands, most deserts, tundra, alpin communities, coastal marshes and wet meadows ef. forested, range.

Range condition. The current productivity of a range relative to what that range is naturally capable of producing. A measure of the health of the range.

Range improvement. Any structure or practice designed to improve range condition or facilitate better range utilization.

Range inventory. A list of resources of a management area, including range sites, range condition and trend, degree of use, stocking rates, physical improvements and natural features.

Range Management. A distinct discipline founded on ecological principles and dealing with the use of rangelands and range resources for a variety of purposes. These purposes include use as watersheds, wildlife habitat, grazing by livestock, recreation, and acsthetics, as well as other associated uses.

Range readiness. The defined stage of plant growth at which grazing may begin under a specific management plan.

Range site. Synonymous with ecological site when referring to rangeland which has the potential to produce and sustain distinctive kinds and amounts of vegetation to result in a characteristic plant community under its particular combination of environmental factors, particularly climate, soils, and associated native biota. Some agencies use rangesite based on the climax concept, not potential natural community. ef. vegetation type.

Range trend. The direction of change in range condition, whether improving, deteriorating or remaining stable.

Rhizome. An underground stem with nodes, scale-like leaves and internodes.

Ruminant. A hoofed mammal that chews the cud.

Sod grass. Stoloniferous or rhizomatous grass which forms a sod or turf.

Stipules. Leaf-like appendages occurring in paris on each side of the leaf base.

Stocking rate. The number of animals on a unit area of land during a month or a grazing season. This is usually expressed in AUMS/acre or AUMS/quarter section. For example, a quarter section of land that grazes 10 cows for four months has a stocking rate of 0.25 AUMS/acre of 40 AUMS/quarter.

Stocking density. The number of animals on a given area of land at any moment in time. For example, and acre of land grazing 50 head of cows for one day each year would have a stock density of 50 head per acre on that day, but a stocking rate of 1.66 AUMS/acre.

Succession, plant. The process of vegetational development whereby an area becomes successively occupied by different plant communities of higher ecological order.

Transect. A cross section of an area used as a sample for recording, mapping or studying vegetation.

Truncate. Ending abruptly; appearing to be cut off at the end.

Watershed. A total area of land above a given point on a waterway that contributes run-off to the flow at that point. A major subdivision of a drainage basin.

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